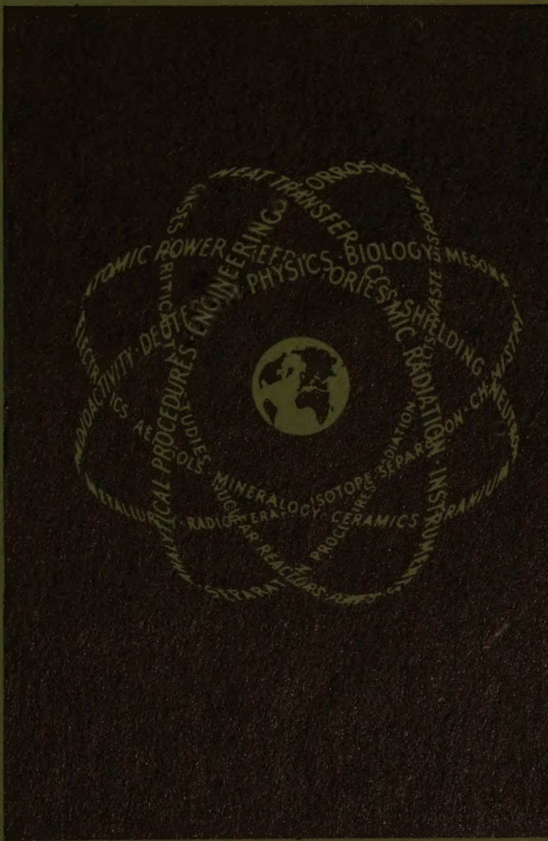
NUCLEAR SCIENCE ABSTRACTS

UNIVERSITY OF ILLINOIS
LIBRARY
JAN 20 1961
CHICAGO



December 15, 1960

Volume 14 Number 23
Abstracts 23837 – 25109

UNITED STATES ATOMIC ENERGY COMMISSION
Technical Information Service

USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U.S. that are abstracted in NSA.

ALABAMA
Auburn, Auburn University
Birmingham, Public Library

ARIZONA
Tucson, University of Arizona

ARKANSAS
Fayetteville, University of Arkansas

CALIFORNIA
Berkeley, University of California
Los Angeles, University of California
Menlo Park, Stanford Research Institute
San Diego, Public Library

COLORADO
Denver, Public Library

CONNECTICUT
New Haven, Yale University

DELAWARE
Newark, University of Delaware

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Coral Gables, University of Miami
Gainesville, University of Florida

GEORGIA
Atlanta, Georgia Institute of Technology

HAWAII
Honolulu, University of Hawaii

ILLINOIS
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois

INDIANA
Indianapolis, Public Library
Lafayette, Purdue University

IOWA
Ames, Iowa State University

KANSAS
Manhattan, Kansas State University

KENTUCKY
Lexington, University of Kentucky
Louisville, University of Louisville

LOUISIANA
Baton Rouge, Louisiana State University
New Orleans, Tulane University

MARYLAND
Baltimore, Johns Hopkins University
College Park, University of Maryland

MASSACHUSETTS
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology

MICHIGAN
Ann Arbor, University of Michigan
Detroit, Public Library

MINNESOTA
Minneapolis, University of Minnesota

MISSOURI
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University

MONTANA
Bozeman, Montana State College

NEVADA
Reno, University of Nevada

NEW JERSEY
Princeton, Princeton University

NEW MEXICO
Albuquerque, University of New Mexico

NEW YORK
Buffalo, University of Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, Public Library
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA
Charlotte, Charlotte and Mecklenburg County Public Library
Durham, Duke University
Raleigh, North Carolina State College

OHIO
Cincinnati, University of Cincinnati
Cleveland, Public Library
Columbus, Ohio State University
Toledo, University of Toledo
Youngstown, Youngstown University

OKLAHOMA
Stillwater, Oklahoma State University

OREGON
Corvallis, Oregon State College
Portland, Reed College

PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University

PUERTO RICO
Rio Piedras, University of Puerto Rico

RHODE ISLAND
Providence, Brown University

SOUTH CAROLINA
Columbia, University of South Carolina

TENNESSEE
Knoxville, University of Tennessee
Memphis, Public Library
Nashville, Joint University Libraries

TEXAS
Austin, University of Texas
College Station, Agricultural and Mechanical College of Texas
Dallas, Southern Methodist University
Houston, Rice Institute
San Antonio, Public Library

UTAH
Salt Lake City, University of Utah

VIRGINIA
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia

WASHINGTON
Pullman, Washington State University
Seattle, University of Washington

WEST VIRGINIA
Morgantown, West Virginia University

WISCONSIN
Madison, University of Wisconsin
Milwaukee, Public Library

WYOMING
Laramie, University of Wyoming

NUCLEAR SCIENCE ABSTRACTS

A Semimonthly Publication of the United States Atomic Energy Commission Office of Technical Information

PURPOSE AND SCOPE

Nuclear Science Abstracts (NSA) serves scientists and engineers interested in the field of atomic energy by providing abstracts of the literature on nuclear science and engineering as well as immediate and detailed indexes to that literature.

***NSA* covers (1) research reports of the United States Atomic Energy Commission and its contractors; (2) research reports of government agencies, universities, and industrial research organizations on a world-wide basis; (3) translations, patents, books, and articles appearing in technical and scientific journals.**

ARRANGEMENT OF ABSTRACTS

Abstracts are arranged according to broad subject categories as illustrated by the Contents (page iii). A new system of subject categories has been introduced in Volume 14.

INDEXES

Indexes in Individual Issues

Each issue of *NSA* includes personal and corporate author, subject, and report number indexes. Report numbers are also indicated in the author and subject indexes. The author indexes include "short" titles of the items indexed. The Report Number Index provides information on the availability of the reports.

Cumulated Indexes

The indexes included in the individual issues are cumulated quarterly, semiannually, and annually. A cumulated report number, author, and subject index covering Vols. 1 through 4 (July 1948–1950) is included in the bound Vol. 4 which is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. ($6.00). A subject and author index covering Vols. 5 through 10 (1951–1956) is available from the Superintendent of Documents ($5.25).

A cumulated report number index to *NSA* through Vol. 13 (1959) and to its predecessor, *Abstracts of Declassified Documents*, has been issued separately as report TID-4000, 5th Ed., *Public Availability of Reports Abstracted in Nuclear Science Abstracts*. This report is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. ($5.00).

AVAILABILITY OF *NSA*

Sale

The semimonthly abstract issues and the four cumulated-index issues of *Nuclear Science Abstracts* are available postpaid on subscription and in single copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at the prices indicated below:

Semimonthly issues. Annual subscription rate: $18.00, domestic; $22.50, foreign. Price per single copy: $1.25, domestic; 25 per cent extra for foreign mailing.

Cumulated-index issues. Annual subscription rate: $15.00, domestic; $17.50, foreign. Price per single copy varies according to the number of pages.

Domestic subscription rates apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.

Foreign subscription rates apply to Argentina, Brazil, British and French Guiana, Surinam, British Honduras, and all other countries throughout the world.

Exchange

NSA is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Journal articles, books, and other privately published materials are not available from the AEC. Detailed information on obtaining reports and translations is given in the introduction to the Report Number Index.

U. S. Patents

Copies of U. S. patents may be ordered from the U. S. Patent Office, Department of Commerce, Washington 25, D. C. ($0.25 per copy).

United Kingdom Patents

Copies of United Kingdom patents may be ordered from The Patent Office, 25, Southampton Buildings, London W.C.2, England ($0.49 per copy).

Use of funds for printing this publication has been approved by the Bureau of the Budget, July 29, 1960.

Y3.At 7:16/14-23

CONTENTS

Volume 14, Number 23, December 15, 1960

Category	Abstract	Page
GENERAL AND MISCELLANEOUS	23837	3083
BIOLOGY AND MEDICINE		
General and Miscellaneous	23847	3084
Biochemistry, Nutrition, and Toxicology	23884	3089
Fallout and Ecology	23892	3091
Radiation Effects on Living Tissues	23916	3095
Radiation Sickness	24022	3112
CHEMISTRY		
General and Miscellaneous	24031	3113
Analytical Procedures	24053	3116
General Inorganic and Physical Chemistry	24117	3124
Radiation Chemistry and Radiochemistry	24149	3127
Raw Materials and Feed Materials	24182	3132
Separation Processes	24188	3133
ENGINEERING AND EQUIPMENT		
General and Miscellaneous	24214	3136
Heat Transfer and Fluid Flow	24231	3138
Instrumentation	24244	3140
Materials Testing	24351	3154
GEOLOGY, MINERALOGY, AND METEOROLOGY	24353	3154
HEALTH AND SAFETY	24380	3158
INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS	24413	3162
ISOTOPE SEPARATION	24450	3168
MATHEMATICS AND COMPUTERS	24455	3168
METALS, CERAMICS, AND OTHER MATERIALS		
General and Miscellaneous	24465	3169
Corrosion	24506	3175
Fabrication	24520	3177
Properties and Structure	24543	3180
Radiation Effects	24622	3190
PHYSICS		
General and Miscellaneous	24648	3193
Astrophysics and Cosmology	24754	3206
Cosmic Radiation	24757	3206
Criticality Studies	24766	3207
Elementary Particles and Radiations	24768	3207
Nuclear Properties and Reactions	24829	3215
Particle Accelerators	24922	3228
Plasma Physics and Thermonuclear Processes	24935	3229
Shielding	24994	3234
Theoretical Physics	24998	3235
REACTOR TECHNOLOGY		
General and Miscellaneous	25001	3235
Power Reactors	25043	3241
Production Reactors	25084	3247
Research Reactors	25085	3247
WASTE DISPOSAL AND PROCESSING	25102	3248
CORPORATE AUTHOR INDEX		INDEX- 1
PERSONAL AUTHOR INDEX		INDEX- 9
REPORT NUMBER INDEX		INDEX-46
SUBJECT INDEX		INDEX-54

Legal Notice

The AEC reports listed in this document are accounts of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in these reports, or that the use of any information, apparatus, method, or process disclosed in these reports may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in these reports.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

NUCLEAR SCIENCE ABSTRACTS

Volume 14 Number 23 December 15, 1960

GENERAL AND MISCELLANEOUS

23837 LMSD-288140(Vols. I and II)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME I. PROPULSION CHEMISTRY AND PROPULSION PHYSICS. VOLUME II. METALLURGY AND CHEMISTRY. Jan. 1960. (Vol. I, 200p. and Vol. II, 271p.).

These two volumes were issued separately, but are cataloged as a unit.

The results obtained from theoretical and experimental studies are assembled into a collection of research reports. The reports comprise a series of papers that deal with various topics in the metallurgy and chemistry of beryllium and niobium and in propulsion chemistry and propulsion physics. Separate abstracts were prepared for 9 out of 19 papers. (W.D.M.)

23838 ORNL-1375(Del.)
Oak Ridge National Lab., Tenn.
AIRCRAFT NUCLEAR PROPULSION PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 10, 1952. W. B. Cottrell, ed. Nov. 19, 1955. Decl. with deletions Nov. 16, 1959. 146p. Contract W-7405-eng-26. OTS.

Progress is reported on the following studies: circulating fuel aircraft reactor experiment (fluid circuit, reflector coolant, pressure-shell stress analysis, off-gas system); experimental reactor engineering (pumps, valves, heat exchangers, instrumentation, fluid dynamics, technology of fluoride handling); reactor physics (oscillations in the circulating fuel reactor, effect of gas on reactivity); critical experiments (direct-cycle reactor, ARE critical assembly); nuclear measurements (fission cross section of U^{234} and U^{236}, total cross section of N^{14}); chemistry of high-temperature liquids (fuel mixtures containing UF_4 and UF_3, alkali fluoborate systems, differential temperature curve of $NaF-ZrF_4-UF_4$, x-ray studies of complex fluoride systems, simulated fuel mixture for cold critical experiment, coolant development, hydrolysis and oxidation of fuel mixtures, reaction of fuels with alkali metals); corrosion research (parametric studies of fluoride corrosion, fluoride corrosion in thermal-convection loops, compatibility of BeO with fluoride mixtures, hydroxide corrosion, liquid-metal corrosion, fundamental corrosion research); metallurgy and ceramics (welding, tests of brazing alloys, reduction of MoS_2); heat-transfer and physical properties research (viscosity of fuel mixtures, heat capacity of LiOH, thermal conductivity of fluoride salt mixtures, vapor pressure of fuel constituents, convective heat transfer in liquid NaOH, boiling heat transfer in Hg); radiation damage (radiation of fused materials, creep under irradiation); and analytical chemistry (analytical studies of components of fluoride mixtures analytical studies of impurities in fluoride mixtures, determination of C in ZrF_4 and $Zr-NaF-C$ mixtures). (W.L.H.)

23839 RM-2562-AEC
RAND Corp., Santa Monica, Calif.
CONCEALMENT OF UNDERGROUND EXPLOSIONS. Albert L. Latter. Mar. 16, 1960. 7p. Contract AT(11-1)-135. OTS.

The Cowboy experiments on decoupling of underground nuclear explosions show that the principle of decoupling by means of a large hole is correct. The decoupling factor of 300 estimated in RAND Report R-348 is still the best estimate for a hole in salt relative to a tamped shot in Nevada tuff. It was found that decoupling is not an all or none effect and that, if the elastic limit of the medium is exceeded, the decoupling factor is reduced, but only gradually. As a result it appears possible to explode a 20-kt device in a cavity no bigger than some which already exist, without producing a signal that could be detected by the Geneva system. (auth)

23840 TID-3700
Office of Technical Information Extension, AEC.
INFORMAL LISTING OF BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE. Bibliographies Issued or in Progress During the Period, June—July 1960. 25p.

Informal Supplement Number 5 to TID-3043(Rev. 1) (Suppl. 1).

Every two months the Office of Technical Information issues informal supplemental listings of bibliographies issued and in preparation during that period of time. (W.D.M.)

23841 UCRL-5993
United ElectroDynamics, Inc., Pasadena, Calif. and California. Univ., Livermore. Lawrence Radiation Lab.
SHEAR AND COMPRESSIONAL VELOCITY MEASUREMENTS. R. J. Swain, C. L. Heald, and D. T. Snodgrass. Apr. 1960. 64p. Project HOBO. Contract W-7405-eng-48. OTS.

Three groups of 100 ft holes were drilled vertically downward from the floor of U 12e main tunnel and U 12e.03 drift at the Nevada Test Site. Distances between holes in each group varied from 13 to 375 ft. One hole in each group was used as a shot hole; the others for seismometers to record the energy generated in the shot hole. Two types of recordings were made; one for dilatational or longitudinal "P" waves and one for transverse or shear "S" waves.

Simultaneous recordings were made on photographic paper and on magnetic belts with a minimum of three specimen records at each hole for each type of recording. The magnetic belts were transcribed to ½-in. IRIG tape for computer use. Rock density measurements were also made in the holes. From these data Poisson's ratio, bulk modulus, rigidity modulus, and Young's modulus were computed. Elastic constant values obtained in situ are much higher than those determined by soils laboratory tests on small rock samples. The data obtained are considered to be of exceptionally high accuracy. (auth)

23842 UCRL-6013
California. Univ., Livermore. Lawrence Radiation Lab.
PROBING THE EARTH WITH NUCLEAR EXPLOSIONS.
D. T. Griggs and F. Press. July 7, 1960. 40p. Contract W-7405-eng-48. OTS.

Progress in seismology is reviewed with emphasis on the usefulness of past nuclear weapon tests in determining the internal structure of the earth. The advantages of using large chemical explosions and future nuclear explosions detonated under the Plowshare program as controlled energy sources for carefully instrumented seismological experiments are discussed. Finally, an international program of explosions for seismological research is proposed, and specific suggestions are made for attacking several outstanding problems in seismology by means of chemical and clean nuclear explosions and the instrumentation network proposed at Geneva for nuclear test detection. (auth)

23843 UCRL-Trans-514(L)
EXPLOSION LAYS DOWN A RIVER BED. Translated from *Pravda*, No. 85(14479), Mar. 25, 1958. 1p. JCL and LC.

An explosion of a 3100-ton charge, which laid down a drain channel for the Kalonga River, is described. The channel that was thus formed is 1150 m long, 100 m wide, and 25 m deep. The channel was conceived to divert the river from its flow over rich iron ore deposits. (J.R.D.)

23844
THE TECHNICAL FACTORS WHICH DETERMINE THE OVERALL COST OF NUCLEAR POWER. Myron C. Beekman (Detroit Edison Co., Detroit). *Ing. nucleare* 3, 11-19(1960) Jan.-Feb. (In Italian)

Many factors influence the over-all cost of installations for exploitation of nuclear power. The building of nuclear power plants to supply electricity at prices competitive with those of conventional power can be achieved by training study and research sights on the following targets: (1) the "over-design" in systems and components must be reduced; (2) less costly materials and construction methods must be used; (3) the size of individual units must be increased; (4) thermal efficiencies must be improved; (5) systems and components must be simplified; (6) applicable standards and codes must be developed; (7) fuel cycle costs must be reduced; and (8) operating and maintenance expenses must be minimized. All these factors are examined singly and in their inter-relationships. Their principal aspects are analyzed in the light of the major examples provided by existing installations. (auth)

23845
IMPROVEMENTS IN OR RELATING TO GAS FILTERS. Austin Edward Johnson and Edgar John Higham (to United Kingdom Atomic Energy Authority). British Patent 846,495. Aug. 31, 1960.

An improved method for impregnating fibrous gas-filter mats with viscous oils, e.g., silicone oil, is presented in which an emulsion is formed from silicone oil (30 to 40%), a wetting agent (10 to 20%), and water using supersonic vibrations. The filter is immersed in the emulsion, the emulsion is broken down by high-pressure air jets, and the water is driven off by hot air. This method results in more uniform oil distribution in the filter, elimination of fire hazards such as are introduced by solvents, lower costs (no solvent recovery systems required), improved filter performances, and higher filter efficiencies. (D.L.C.)

23846
IMPROVEMENTS IN OR RELATING TO APPARATUS COMPRISING GLASSWARE. Fred Jones (to United Kingdom Atomic Energy Authority). British Patent 846,746. Aug. 31, 1960.

The utility of glassware in plants for handling solutions can be greatly extended by embedding in a hard resin, e.g., Ceemar resin mixed with hardener and liquid accelerator which is cold setting. In this way, fluid connections can be made to glassware by means of flexible pipe without stresses because the resin makes the connection fluid-tight, and support means, e.g., rods or holes, can be embedded or installed in the resin. Drawings are given of a glass vacuum tap, an absorption cell, and a manometer embedded in resin. (D.L.C.)

BIOLOGY AND MEDICINE

General and Miscellaneous

23847 AF-SAM-60-15
Texas. Univ., Austin. Radiobiological Lab. and School of Aviation Medicine, Brooks AFB, Tex.
LIQUID SCINTILLATOR BETA COUNTING OF IRON-59 IN CLEAR AND COLORED SYSTEMS. Thomas P. Leffingwell, Robert W. Riess, and George S. Melville, Jr. Aug. 4, 1959. 11p.

National Bureau of Standards $Fe^{59}Cl_3$ was employed in model systems to quantitate liquid scintillator beta counting of Fe^{59}. In systems containing a colored iron—*ortho*-phenanthroline chelate, decline in counting efficiency is a linear function of color density for the concentration gradient investigated. However, presence of the colored chelate causes an increased photon yield relative to the corresponding visibly colorless sample. The enhanced photon yield elevates the entire coincidence counting-efficiency curve by approximately 6%. The enhancement phenomenon is (1) chelate-concentration dependent, (2) β-particle energy dependent, (3) at its maximum at the emission peak of the scintillators in the counting system employed, (4) effected only in the presence of the scintillators, and (5) γ-ray independent. (auth)

23848 AF-SAM-60-18
School of Aviation Medicine, Brooks AFB, Tex.
NEUTRON ACTIVATION OF BIOLOGIC MATERIALS. NEUTRON EXPOSURE FACILITY. David R. Rovner. Sept. 10, 1959. 9p.

A facility for exposing biologic materials to neutrons of varying energies is described. The primary source is a linear accelerator which utilizes a 100 kv potential to accelerate deuterium ions and targets consisting of both deuterium and tritium. Calibration of the monitoring equipment and operating controls is discussed. The dosimetry of the neutron field is explained and doses at various points are calculated. The maximum flux available is 1.0×10^9 n/sec, representing a dose of 93 rep/hr at

4.5 cm from the target. Measures for radiation safety are briefly described. (auth)

23849 TID-3903
Division of Biology and Medicine, AEC.
A SELECTED LIST OF REFERENCES ON MARINE AND AQUATIC RADIOBIOLOGY. A. W. Klement, Jr., and I. E. Wallen, comps. May 20, 1960. 44p. OTS.

References are given for report, published, and translation literature from various sources. (W.L.H.)

23850 UR-577
Rochester, N. Y. Univ. Atomic Energy Project.
UNIFYING CONCEPTS OF PARATHYROID HORMONE ACTION. A. Raymond Terepka, Charles M. Dowse, and William F. Neuman. July 22, 1960. 28p. Contract W-7401-eng-49. OTS.

The multiplicity of actions of parathyroid hormones has been emphasized by recent research. Apparently not one, but several, organs show specific and remarkably similar responses: bone, kidney, intestine and mammary gland. Old and even present concepts of the hormone's actions are not sufficiently general to encompass the variety and seeming divergence of data currently available, whether from the laboratory or the clinic. A working hypothesis is presented which represents the most profitable area of parathyroid research presently amenable to experimental attack. This concept seems, at the moment, to best explain the known actions of the hormone at the cellular level. (auth)

23851 WADC-TN-59-214
Wright Air Development Center, Wright-Patterson AFB, Ohio.
MODIFICATION OF TECHNIQUES FOR DETERMINING THE UPTAKE OF IRON-59 IN NEWLY FORMED RED BLOOD CELLS. Rodney L. Preston and Arthur P. Raun. Dec. 1959. 10p. Project No. 7164. (AD-234459). OTS.

Data are presented on the validity of a simplified technique for measuring the incorporation of radioactive Fe^{59} into newly formed red blood cells in the rats following intraperitoneal administration of the isotope. The method, as described herein, should prove useful in measuring this physiological process under experimental conditions where erythropoiesis may be disturbed. (auth)

23852 JPRS-2287
CYTOLOGY. Translation of Tsitologiya, Volume I, No. 4, 1959. 196p. OTS.

23853 UCRL-Trans-561
THE EFFECT OF OXYGEN ON THE EPR OF SPECTRA OF LYOPHILIZED TISSUES. G. K. Morozova and L. A. Blyumenfel'd. Translated from Biofizika 5, 235-8(1960). 12p. (Includes original, 4p.). JCL or LC.

The effect of O_2 on the electron paramagnetic resonance (EPR) spectrum of lyophilized animal tissue was studied using a spectrometer with high-frequency magnetic modulation and a sensitivity of 10^{-11} M. The results of other workers to the effect that the EPR signal was weakened in vacuum are not substantiated. (T.R.H.)

23854
TECHNIQUE FOR INTRACAVITARY IRRADIATION OF THE NASOPHARYNX. Herman D. Suit, Ralph S. Lloyd, J. Robert Andrews, and Stanley E. Sneider. (National Cancer Inst., Bethesda, Md.) Am. J. Roentgenol., Radium Therapy Nuclear Med. 84, 629-31 (1960) Oct.

A technique for the preparation of accurate plastic molds of the nasopharynx has been described. These molds are used as radiation source carriers in the supplementary irradiation of certain neoplasms of the nasopharynx. No surgical resection of the palate or nasal septum is required to obtain accurate positioning of the mold and radiation sources. (auth)

23855
INITIAL EXPERIENCE WITH SPLIT-DOSE PERIODIC RADIATION THERAPY. Paul W. Scanlon (Mayo Clinic, Rochester, Minn.). Am. J. Roentgenol., Radium Therapy Nuclear Med. 84, 632-44(1960) Oct.

The potential usefulness of split dose or periodic radiation therapy in the treatment of tumors of the head and neck is reviewed. 21 references. (C.H.)

23856
CONTRIBUTION OF PLASMA CONSTITUENTS PRODUCED FOLLOWING WHOLE BODY IRRADIATION ON THE EFFICACY OF LOCAL RADIATION THERAPY. Melvin R. Sikov and James E. Lofstrom (Wayne State Univ. Coll. of Medicine, Detroit). Am. J. Roentgenol., Radium Therapy Nuclear Med. 84, 705-11(1960) Oct.

The amount of oncolysis produced by localized roentgen irradiation can be substantially increased by administering a small increment of the tumor dose as whole-body irradiation. The exact quantitative relations between the doses for local and systemic exposures were found to be quite complex although 50 r of total-body irradiation was often sufficient to elicit maximum effect. This increased oncolysis can be partially simulated by administering plasma from previously irradiated animals together with irradiation of the tumor. This was interpreted as indicating that some substance or substances are present in the plasma following total-body irradiation which may be involved in the synergism. (auth)

23857
SOME EFFECTS OF D_2O IN VIVO AND IN VITRO ON CERTAIN ENZYMES OF RAT TISSUES. J. F. Thomson and Florence J. Klipfel (Argonne National Lab., Ill.). Biochem. Pharmacol. 3, 283-8(1960) July.

In animals that had drunk 50% heavy water until about one-third of their body water was replaced by D_2O, changes were observed in the tissue levels of several enzymes. The arginase and oxalacetate transaminase activities of rat liver were significantly increased; alanine transaminase was unchanged. Tryptophan pyrrolase was elevated slightly in livers of unadapted rats; however, there was marked suppression of the increase in activity induced by injection of tryptophan. The activity of glutamic acid decarboxylase of rat brain was depressed by D_2O in vitro, but the concentration of this enzyme was not changed by feeding D_2O. Mitochondria prepared from liver and kidney of D_2O-treated rats showed a diminished capacity to oxidize fumarate and α-ketoglutarate, but not succinate; the efficiency of phosphate esterification was unaffected. D_2O (30%) in vitro did not affect transaminase activity or oxidative phosphorylation. (auth)

23858
THE APPLICATION OF STORED AUTOLOGOUS BONE MARROW IN THE TREATMENT OF ADVANCED MALIGNANT DISEASE. A. CLINICAL ASPECTS. K. A. Newton (Westminster Hospital, London). Brit. J. Radiol. 33, 577-80(1960) Sept.

Recent studies are reviewed on the clinical aspects of the application of stored autologous bone marrow in the treatment of advanced malignant disease. It is concluded that the aid of autologous-marrow transfusion will allow large field irradiation and large dose chemotherapy with less regard to the hematological complications implicit in this type of treatment. (C.H.)

23859

THE APPLICATION OF STORED AUTOLOGOUS BONE MARROW IN THE TREATMENT OF ADVANCED MALIGNANT DISEASE. . B. HAEMATOLOGICAL ASPECTS. J. G. Humble (Westminster Hospital, London). Brit. J. Radiol. 33, 580-1(1960) Sept.

Experiences are reviewed in the application of bone-marrow transplantation to overcome the severe hemopoietic and lymphopoietic depression which follows large-volume high-dosage radiotherapy and also high-dosage chemotherapy for a malignant disease. (C.H.)

23860

SCINTILLOGRAPHY IN DIAGNOSTICS AND THERAPY. K. E. Scheer and K. Zum Winkel (Universität, Heidelberg, Ger.). J. belge radiol. 43, 294-309(1960). (In French)

The principle and methods of application of scintillography are exposed as well as some examples of the importance of scintillography in the diagnosis of numerous affections of the thyroid gland, the liver, the circulatory system and the cerebral tumors. A discussion of the diagnostic value and of the possibilities of development of this technique is given. (auth)

23861

THE IMPORTANCE OF SECONDARY RADIATION FROM FILTERS OF Co^{60} PREPARATIONS IN THEIR INTRACAVITARY USE. A. A. Stankevich (Inst. of Oncology, Academy of Medical Sciences, USSR). Med. Radiol. 5, No. 7, 32-6 (1960) July. (In Russian)

The use of Co^{60} for intracavitary therapy does not require filters from heavy metals. The employment of filters from copper and stainless steel diminish the amount of injury in the adjacent tissues as compared with filters from heavy metals. (auth)

23862

THE ASSAY OF TRITIUM IN BIOLOGICAL MATERIAL BY WET OXIDATION WITH PERCHLORIC ACID FOLLOWED BY LIQUID SCINTILLATION COUNTING. E. H. Belcher (Postgraduate Medical School of London). Phys. in Med. Biol. 5, 49-56(1960) July.

A method is described for preparing biological specimens for tritium assay by liquid scintillation counting. The method depends on oxidation by a mixture of nitric acid and perchloric acids. Tritiated water mixed with acids is distilled from the reaction vessel; the acid distillate is neutralized with ammonium hydroxide and incorporated in a liquid scintillator based on toluene and ethyl alcohol. Results of recovery experiments with known amounts of tritium are presented. (auth)

23863

A SUMMARY OF THE DATA OF MECHANIK ON THE DISTRIBUTION OF HUMAN BONE MARROW. Helen Q. Woodard and Edward Holodny (Memorial Center for Cancer, New York). Phys. in Med. Biol. 5, 57-9(1960) July.

The data of Mechanik on the amount and distribution of human marrow spaces have been summarized in two short tables suitable for clinical use. The reliability of the data is discussed. (auth)

23864

SOME OBSERVATIONS ON ABSORPTION OF CESIUM BY EXCISED BARLEY ROOTS. G. G. J. Bange and Roy Overstreet (Univ. of California, Berkeley). Plant Physiol. 35, 605-8(1960)

Steady-state cesium absorption was studied in relation to the external cesium concentration and under conditions of low temperature and anoxybiosis. The results are tentatively explained on the basis of a two-fold absorption mechanism. The first mechanism is very effective, reaching a saturation level at a concentration as low as 0.1 meq/l (half-value ~ 0.008 meq/l). Absorption at this concentration was shown to be sensitive to anoxybiosis. The second mechanism becomes relatively important only at concentrations a hundred-fold higher and is insensitive to anoxybiosis. The possibility of a passive nature of the second mechanism is discussed. The interference by other mono- and divalent cations with cesium absorption in the concentration range from 0.0 to 0.1 meq/l was studied. Potassium, rubidium, and to a lesser extent, NH$_4$ inhibited cesium uptake in a way suggesting competition for the same binding site. Lithium and magnesium had little effect on cesium absorption; sodium and calcium only affected the over-all absorption capacity for cesium; sodium in a negative sense and calcium in a positive sense. (auth)

23865

THE PHARMACOLOGY OF RADIOPROTECTANT CHEMICALS. GENERAL PHARMACOLOGY OF β-MERCAPTOETHYLAMINE. Roy L. Mundy and Melvin H. Heiffer (Walter Reed Army Medical Center, Washington, D. C.). Radiation Research 13, 381-94(1960) Sept.

When 100 mg of β-mercaptoethylamine is administered intravenously to the dog over a period of 5 min a characteristic set of reactions is produced. The most notable of these in the nonanesthetized dog are violent emesis, agitation frequently leading to tonic-clonic convulsions, ataxia and a characteristic swaying movement of the front portion of the body, generalized depression, loss of pain sense, severe hypotension, relative bradycardia, blood-tinged diarrhea, and a mixed stimulation and depression of respiration. Anesthesia prevents the emetic and convulsive components of the reaction but does not affect the cardiovascular changes. The agent produces a delayed, severe, prolonged hypotension. The possibility is discussed that the physiological changes produced by this agent may contribute to its radioprotective potential. 27 references. (auth)

23866

PERIPHERAL BLOOD PICTURE IN THE ALBINO RAT IN NORMAL CONDITIONS AND AFTER TREATMENT WITH LARGE DOSES OF CYSTEAMINE. U. Nuvolone and M. L. Tognacca (Università, Messina, Italy). Radiobiol. Latina 2, 311-19(1959) Oct.-Dec. (In Italian)

The changes in the peripheral blood of albino rats following prolonged treatment with cysteamine were studied. High doses produce leucopenia and erythropenia with relative granulocytosis and lymphopenia. (auth)

23867

VISUALIZATION OF THE SPLEEN IN MAN BY RADIOISOTOPE SCANNING. James W. Winkelman, Henry N. Wagner, John G. McAfee, and James M. Mozley (Johns Hopkins Hospital, Baltimore). Radiology 75, 465-6(1960) Sept.

On the basis of the observation that heated red blood cells concentrate in the spleen, a simple technic which gave a good spatial image of the spleen was developed. The cubic centimeters of the patient's blood were withdrawn into a sterile syringe containing 2 cc of ACD anticoagulant. Two hundred microcuries of Cr^{51} sodium chromate were added. After incubation at room temperature for fifteen minutes, 50 mg of ascorbic acid were added to reduce residual chromate to chromic ions. The tube was then incubated in a water bath at 49.5°C ± 1° for one hour. After cooling, the blood was administered intravenously. Heating of the red blood cells increased osmotic fragility but did not cause hemolysis. By phase microscopy, the heated red cells exhibited poikilocytosis, anisocytosis, and pseudopodial bulges from the surface. In vivo counting following injection revealed maximum concentration of the altered red blood cells in the spleen between one and two hours. Scintillation scanning was then performed with the patient supine. A 3 × 3-in. sodium iodide crystal, 12-hole focusing collimator, and scintillation spectrometer were used. The scanning image was produced by a high-contrast photorecorder on regular x-ray film. A routine abdominal radiograph was obtained on the scanning stretcher for accurate localization of the scanning image. In each of 17 subjects, the technic produced a clearly delineated image of the spleen. (auth)

23868

RADIATION BIOLOGY. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society. J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959. 304p. $11.00.

This collection of papers provides a source of new data not only for research workers interested in purely scientific objectives, but for those concerned generally with the human implication of radiobiology. Thirty-one papers are included for which separate abstracts have been prepared. (B.O.G.)

23869

LEUKAEMIA TREATED BY RADIATION. J. F. Loutit (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.47-55 of "Radiation Biology."

The discussion is confined to work concerning leukemia in the mouse. The work on mice stemmed from observations by Jacobson that mice which had received a lethal dose of x rays might recover following suitable treatment. The treatment consisted of implanting spleens from normal animals into the peritoneal cavities. Lorentz et al. carried the observations further, demonstrating that suspensions of cells from bone marrow administered by injection after the irradiation were effective as therapy. Injections by the intravenous route gave better results than those given intraperitoneally. Successful results were obtained when homologous bone marrow from mice of different strains and heterologous bone marrow from animals of a different species (guinea-pigs) was injected intravenously. It was shown by Congdon and Lorentz that rat bone marrow, as well as guinea-pig bone marrow, was effective. Evidence here has indicated that not only was the bone marrow of the irradiated animal recolonized by the injected cells but also the lymphoid tissues. (B.O.G.)

23870

SHORT-TERM STUDIES OF THE EFFECT OF RADIOIODINE THERAPY FOR THYROTOXICOSIS ON THE THYROIDAL IODIDE CLEARANCE RATE. I. D. Thomas, T. H. Oddie, and F. F. Rundle (Royal North Shore Hospital, Sydney). p.244-7 of "Radiation Biology."

Iodine uptake studies of patients who have received radioiodine therapy for thyrotoxicosis give results that frequently cannot clearly be correlated with the patient's clinical status. It was concluded that thyroidal iodine uptake behaves capriciously after the administration of therapeutic radioiodine, the corollary being that uptake studies are of little value in the follow-up of these patients. The variations in iodide clearance rate or uptake were followed in 16 thyrotoxic patients during the first month after radioiodine therapy. Estimations of clearance rate were made 5, 13, and 28 days after receiving the dose. The time at which the greatest lowering of uptake occurred and the level of the uptake in relation to the usual diagnostic ranges are noted. The results suggest that the mode of response in the first 28 days may be of value in determining whether or not the patient will obtain a satisfactory therapeutic response to the dose received. (B.O.G.)

23871

A SYMPOSIUM ON RADIOISOTOPES IN THE BIOSPHERE. Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960. 597p.

A symposium on the ecology of radioisotopes was held at the University of Minnesota, Minneapolis, from October 19 to 23, 1959. In addition to the University, the sponsors of the meeting were the National Science Foundation; the Atomic Energy Commission; and the Agricultural Research Service, United States Department of Agriculture. Separate abstracts have been prepared on thirty-seven papers presented at this symposium. (C.H.)

23872

RADIOISOTOPES AND THE GENETIC MECHANISM: CYTOLOGY AND GENETICS OF DIVALENT METALS IN NUCLEI AND CHROMOSOMES. Dale Steffensen and Leo E. LaChance (Brookhaven National Lab., Upton, N. Y.). p.132-45 of "A Symposium on Radioisotopes in the Biosphere."

Cytological studies with Tradescantia have indicated that metal deficiencies result in higher frequencies of spontaneous chromosome breakage and that calcium, magnesium, and strontium are likely metals involved in chromosome stability. The frequency of chromosome breakage in microspores is dependent on the temperature at which the cells passed through meiosis. Isotope studies with Lilium longiflorum and Habrobracon juglandis have shown that Ca^{45} and Sr^{90} are incorporated into the chromatin material of nuclei and is apparently firmly bound in the chromosomes. The possibility of mutational consequences resulting from the incorporation of isotopes in the hereditary material and the possible role for divalent metal ions in the chromosome structure are discussed. 28 references. (auth)

23873

RADIOISOTOPES IN THE SKELETON: LATE OBSERVATIONS ON THE DISTRIBUTION OF RADIUM IN THE HUMAN SKELETON. R. E. Rowland (Argonne National Lab., Ill.). p.339-53 of "A Symposium on Radioisotopes in the Biosphere."

Results are reported from the analysis of bone samples from 19 individuals who carried a body burden of sodium from a minimum of 10 years to a maximum of 40 years. The body burdens ranged from a high of 20 μc down to about one μc of Ra^{226}. Data indicate the existence of two distinctly different isotope distribution patterns in those cases which were exposed only a few years. An intense hot-spot distribution and a uniform diffuse distribution were found in the same individual. Pathological findings are described, and reproductions of autoradiograms of bone samples and tabulated data are included. Applications of the findings in the evaluation of the hazards to mankind of Sr^{90} are discussed. (C.H.)

23874

RADIOISOTOPES IN THE SKELETON: OBSERVATIONS ON DISTRIBUTION IN MAN. Göran C. H. Bauer (Univ. of Lund, Sweden). p.354-65 of "A Symposium on Radioisotopes in the Biosphere."

Present concepts of bone physiology are reviewed. Available information is summarized on the skeletal distribution of radioisotopes of calcium, strontium, barium, sodium, and carbon. Schematic models are presented of calcium kinetics in adult man and the growing child and sodium kinetics in developing bone. Factors that influence the formation and resorption of bone are discussed. (C.H.)

23875

RADIOISOTOPES IN THE SKELETON: NATURALLY OCCURRING RADIOISOTOPES IN MAN. Andrew F. Stehney (Argonne National Lab., Ill.). p.366-81 of "A Symposium on Radioisotopes in the Biosphere."

The water supplies of certain areas of the midwestern United States were found to contain unusually high concentrations of Ra. Analyses of water samples showed that approximately 400,000 persons consume water containing more than 4×10^{-12} g of Ra^{226} per liter. Results are reported from a survey of the body radioactivity of persons who ingested this water. Comparisons were made between body activity and age, length of residence in the region, rate of uptake, and other pertinent factors. Measurements on living subjects were made by the radon-breath method of measuring body Ra. In addition, analyses were made on a number of bone samples collected from the regions. Data are presented graphically on the whole-body Ra^{226} content of men and boys residing for various lengths of time in areas with both high- and low- Ra content in drinking water. Results indicate that food normally provides the main source of Ra for man. Data are tabulated on the natural radioisotopes in the human skeleton. Generalizations are made concerning factors affecting the body burden of Ra from food and drinking water. The contribution of other natural radioisotopes to the radioactivity of man is discussed briefly. 48 references. (C.H.)

23876

RADIOISOTOPE ABSORPTION AND METHODS OF ELIMINATION: RELATIVE SIGNIFICANCE OF PORTALS OF ENTRY. Wright H. Langham (Los Alamos Scientific Lab., N. Mex.). p.489-513 of "A Symposium on Radioisotopes in the Biosphere."

The potential routes of entry of substances into the body are via skin absorption, inhalation, and ingestion. The absorption of radionuclides by animals and man is discussed. Emphasis is placed on the relative significance of portals of entry and their role in the establishment of biospheric equilibrium. Data are reviewed on the percutaneous absorption of H^3, Sr^{89}, U, I^{131}, and Pu^{239}; the inhalation and pulmonary absorption of Pu, U, mixed fission products, Sr^{89}, Sr^{90}, Ce^{144}, and Pu^{239}; and the gastrointestinal absorption of Sr^{90}, Cs^{137}, mixed fission products from fall-out, C^{14}, and C^{45}. These data are used to illustrate the nature of the problems discussed. 70 references. (C.H.)

23877

RADIOISOTOPE ABSORPTION AND METHODS OF ELIMINATION: DIFFERENTIAL BEHAVIOR OF SUBSTANCES IN METABOLIC PATHWAYS. C. L. Comar and R. H. Wasserman (Cornell Univ., Ithaca, N. Y.). p.526-40 of "A Symposium on Radioisotopes in the Biosphere."

An important objective in regard to environmental contamination is to be able to predict the levels of radiocontaminants that will be produced in the human population when the environmental levels are known or can be predicted. It is important to understand the movement of such radiocontaminants so that appropriate action can be taken to decrease the levels in the population when and if necessary. For radiostrontium it appears that the consideration of Sr-Ca ratios is of much greater usefulness than the consideration of Sr retention alone. There appears to be a reasonably constant relationship under normal dietary conditions between Sr-Ca ratios in diet and those in the body or in milk. The Sr-Ca ratio predicted in the body at any given time will reflect the radiocontamination at the local areas in bone that are active at the time. Radiostrontium retentions will vary greatly with age, diet, and other factors. In mature individuals retention will progressively decrease to zero as the skeleton becomes labeled under constant intake; calcium retentions would be expected to be parallel. The behavior of radiostrontium ingested will be related to the calcium intake. The calcium level of the body is reasonably constant regardless of dietary intake under adequate or optimal conditions; the calcium of blood is under close homeostatic control, and tissues are similar in calcium content. This behavior of calcium makes it a good standard of reference. Calcium metabolism and nutrition have been widely studied in the past. For radiocesium there apparently is not the close relationship with K as has been observed for Sr-Ca. Much more data are required for an understanding of Cs behavior and the effects of the important parameters. 21 references. (auth)

23878

RADIOISOTOPE ABSORPTION AND METHODS OF ELIMINATIONS: FACTORS INFLUENCING ELIMINATION FROM THE BODY. Marcia White Rosenthal (Argonne National Lab., Ill.). p.541-63 of "A Symposium on Radioisotopes in the Biosphere."

The outlook for the therapy of radioelement poisoning, both acute and chronic, from Pu, Th, and the rare earths is bright. In the first place, they are not readily absorbed; and in the second, research into the development of more effective chelating agents has already been fruitful, producing first EDTA and recently DTPA. Poisoning from Sr and Ra, however, has not proved very amenable to any of the many therapeutic approaches thus far tested. However, a high Ca balance before exposure and very prompt administration of citrates or application of ion exchange techniques to the blood after exposure have value in minimizing uptake of Sr by the skeleton. 68 references. (auth)

23879

RADIOISOTOPE ABSORPTION AND METHODS OF ELIMINATION: A CRITICAL REVIEW. R. H. Wasserman (Cornell Univ., Ithaca, N. Y.). p.564-73 of "A Symposium on Radioisotopes in the Biosphere."

The ecological chain that has resulted in the introduction of radionuclides into the animal population and subsequently into the human species is reviewed. Methods of removal of radioisotopes are also considered. The need for future studies is emphasized. (C.H.)

23880

TREATMENT OF CANCER AND ALLIED DISEASES. SECOND EDITION. VOLUME I. PRINCIPLES OF TREATMENT. George T. Pack and Irving M. Ariel, eds. New York, Paul B. Hoeber, Inc., 1958. 663p.

Fifty-five authors contributed to this volume in which emphasis is placed on principles of treatment of neoplastic and related diseases. An attempt was made to bring together in one authoritative work the tremendous mass of detailed information concerning the techniques of all phases of cancer therapy in current use. The care of the patient is emphasized throughout, and palliative procedures are presented with emphasis given to measures aimed at cure. It is pointed out that the treatment of cancer is based upon the histogenetic classification of the tumor and the clinical setting of the tumor. Topics discussed include the prevention of cancer, the organization of detection facilities and tumor clinics, the organization of a program for home care of cancer patients, diagnosis and pathology, surgery, the physical basis of radiation therapy, the radiosensitivity of tumors, the biological effects of ionizing radiation, clinical applications of x radiation, clinical applications of radium, the therapeutic use of artificial radioisotopes, the clinical application of systemic radioactive isotopes in cancer therapy, the treatment of cancer with small sources of radioactive gold, the treatment of cancer with small sources of radioactive iridium, the clinical application of small sources of radioactive cobalt, the use of radioactive cobalt beams for cancer therapy, protection in radiation therapy, the treatment of radiation reactions, hormone therapy, chemotherapy and general care of the cancer patient, and methods of reporting end results of cancer treatment. 505 illustrations; 224 references. (C.H.)

23881
TREATMENT OF CANCER AND ALLIED DISEASES. SECOND EDITION. VOLUME II. TUMORS OF THE NERVOUS SYSTEM. George T. Pack and Irving M. Ariel, eds. New York, Paul B. Hoeber, Inc., 1959. 330p.

The diagnosis and treatment of tumors of the nervous system are discussed by 30 authorities in the fields of neurologic surgery and radiation therapy. Highly specialized procedures and new developments in the therapy of neoplasms of the nervous system are described. The modern treatment of brain tumors is based on the development of neurology, the development of diagnostic aids, and the classification of neoplasms of the nervous system on a histogenetic basis. Topics discussed include the classification of neoplasms and their routes of spread, the general and special measures for diagnosing tumors of the nervous system, anesthesia and preoperative and postoperative care of the neurosurgical patient, and the accomplishments and complications of irradiation of neurogenic tumors. Specific neoplasms arising from the central and peripheral nervous systems are discussed according to their histogenetic classification. 340 illustrations; 509 references. (C.H.)

23882
TREATMENT OF CANCER AND ALLIED DISEASES. SECOND EDITION. VOLUME III. TUMORS OF THE HEAD AND NECK. George T. Pack and Irving M. Ariel, eds. New York, Paul B. Hoeber, Inc., 1959. 795p.

Therapeutic methods for tumors of the head and neck are described. Brain tumors are excluded. Both radical and conservative therapeutic methods considered acceptable for tumors of the head and neck are included. Topics discussed include anesthesia and preoperative and postoperative care of patients, treatment of cancers of the head and neck, the histogenic nature of these cancers, the possibility of metastases, surgical and radiologic treatment, methods of surgical reconstruction, factors that influence the choice of treatment, speech rehabilitation following laryngectomy, a method of combining surgical and radiologic treatment, and results of treatment from three of the foremost cancer centers in the world. The sixty-nine authors were drawn from treatment centers over the world. 1028 illustrations; 1204 references. (C.H.)

23883
MECHANISMS IN RADIOBIOLOGY. VOLUME II. MULTICELLULAR ORGANISMS. Maurice Errera and Arne Forssberg, eds. New York, Academic Press, 1960. 406p.

Radiation effects on embryonic and adult organisms are discussed, with emphasis on mammals. Immunological processes in irradiated organisms, the mechanisms of action of protective and sensitizing agents, and the possibilities of enhancing the recovery of irradiated mammals are discussed at length. Applications of paramagnetic resonance measurements for the determinations of free radicals are described. 1657 references. (C.H.)

Biochemistry, Nutrition, and Toxicology

23884 JPRS-2419
MATERIALS ON THE TOXICOLOGY OF RADIOACTIVE IRON. N. D. Sagaydak. Translated from excerpts of Gigiena Truda i Professional.' Zabolevaniya 3, No 6, 22-8 (1959). 14p. OTS.

Iron-59 is used in biology, medicine, agriculture, and industry. The use of the isotope under industrial conditions creates the possibility of the formation of active aerosols. Results are presented from a survey of the air in a metallurgy plant, a cement plant, and a scientific research institute where Fe^{59} was used in the form of a powder of the iron oxide. In all cases the activity of the samples was comparatively low. A study was made of the tissue distribution and effects of chronic exposure to radioactive iron in rats following entry through the respiratory tract. Differences were noted in the distribution and elimination of soluble and insoluble compounds of Fe^{59}. (C.H.)

23885
DISTRIBUTION OF Te^{127,129} IN THE ANIMAL ORGANISM. Yu. I. Moskalev. Med. Radiol. 5, No. 7, 54-60(1960) July. (In Russian)

A study was made of the distribution of Te^{127,129} in the animal organism in intravenous and peroral administration. In intravenous introduction, Te^{127,129} is distributed comparatively uniformly. The highest concentration of tellurium is observed in the lungs and kidneys; it is somewhat lower in the liver, skeleton, and blood; and it is lowest in the brain. Excretion of tellurium from the soft tissues and skeleton is relatively slow, the rate being approximately the same. The highest quantity of tellurium is discharged with the urine. Upon peroral administration 20 to 25% of Te^{127,129} is absorbed from the intestine. In this mode of introduction the highest concentration of tellurium, exceeding that in the liver and skeleton, is found in the kidneys and blood. The largest amount of perorally introduced Te^{127,129} (70 to 75%) passes out with the feces. During the 16 days of the experiment 15% of active tellurium was discharged with the urine. (auth)

23886
THE PROTECTIVE EFFECT OF POTASSIUM IODIDE IN CHRONIC INTRODUCTION OF RADIOIODINE INTO THE ORGANISM. V. L. Shvedov. Med. Radiol. 5, No. 7, 60-3 (1960) July. (In Russian)

Literature data and personal investigations concerned with the protective effect of potassium iodide in chronic administration of radioiodine into the organism are presented. (auth)

23887
CONDITIONS MODIFYING CHOLESTEROL AND FATTY ACID BIOSYNTHESIS. S. Garattini, P. Paoletti, and R. Paoletti (Univ. of Milan). p.184-93 of "Biochemistry of Lipids. Proceedings of the 5th International Conference on the Biochemical Problems of Lipids Held at the 4th International Congress of Biochemistry, Vienna, 1958." G. Popjak, ed. New York, Pergamon Press, 1960.

Compounds able to inhibit cholesterol and fatty acid biosynthesis were investigated as potential agents for decreasing plasma lipids. The activity of α-biphenylbutyric acid was investigated in rats under conditions of experimentally modified liver cholesterol and fatty acid biosynthesis, such as total body x-irradiation, liver regeneration after partial hepatectomy, Triton treatment, and fasting. Results showed almost the same percentage of inhibition on precursor oxidation, cholesterol biosynthesis, and fatty acid biosynthesis. This compound also seemed much more active when lipid biosynthesis was increased and to be chiefly effective before the isoprenoid stage. (M.C.G.)

23888

RADIOISOTOPE TOXICITY: FROM PULMONARY ABSORPTION. W. J. Bair (General Electric Co., Richland, Wash.). p.431-48 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The physiological behavior and biological effects of several radioisotopes after inhalation are described. It is pointed out that there is little uniformity in the deposition, distribution, and behavior of radioactive particles because of the importance of such factors as the diameter and solubility of the particles and the physiological characteristics of the host. It is difficult to extrapolate from one set of experimental conditions to another and similarly from one individual or species to another. Inhalation of compounds of such radioelements as Sr and I in rats and mice is generally followed by rapid lung clearance and translocation to the same tissues that accumulate the isotope after its entry to the body by other routes. Very insoluble compounds, of which $Pu^{239}O_2$ is a good example, are retained in the lungs for a long period of time with slow translocation to other tissues and slow excretion. Pu^{239} showed major translocation to tracheobronchial lymph nodes in both dogs and mice. Retention apparently differed in mice and dogs, thus emphasizing the difficulty in extrapolating to man. Radioisotopes have been shown to produce malignant neoplasms in lungs of rodents. Mice surviving 500 days after inhaling $Pu^{239}O_2$ or $Ru^{106}O_2$ showed gross lymphatic pathology and only minor pulmonary pathology. Larger doses, >0.3 μc $Pu^{239}O_2$, resulted in early mortality. The few that were examined histologically showed no malignant pulmonary tumors. Limited histologic studies of tracheobronchial lymph nodes from dogs after $Pu^{239}O_2$ deposition showed characteristic radiation damage two years after intratracheal deposition of 20 μc. Tracheobronchial lymph nodes taken from dogs 10 months after inhalation of two μc showed possible changes. Autoradiograms showed a greater concentration of Pu^{239} than was seen in lungs of the same animal. The acute lethal dose for dogs was in the 50 to 100 μc range. Other biological effects of inhaled radioisotopes included decreased circulating lymphocyte counts in dogs after $Pu^{239}O_2$ deposition. Chronic inhalation by mice of 10^{-5} μc $Sr^{90}SO_4$/cc of air and less caused minor hematologic changes but no increase in leukemia after two years following the date of deposition. The data indicate an increasing knowledge of the toxicity of inhaled radioisotopes. However, there are still many questions of importance to establishment of maximum permissible concentrations that are not answered. 30 references. (auth)

23889

RADIOISOTOPE TOXICITY: AS RELATED TO THE THYROID. John A. D. Cooper (Northwestern Univ., Chicago). p.449-60 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The considerable yield of radioactive isotopes of iodine in the fission reaction and the unique role of the thyroid gland in the metabolism of iodine may result in the concentration of relatively high doses of radiation to a small quantity of tissue. Reports of increased incidence of carcinoma of the thyroid in children exposed to ionizing radiation in the region of the neck form the basis of speculations about hazards which may result from the presence of radioiodine in the gland. Data are summarized on pertinent aspects of iodine metabolism in man, present levels of radioiodine contaminating the environment, the pathways and amount of radioiodine that reach man, and the effects that the radiation levels involved may be postulated to produce on the basis of current information. 36 references. (C.H.)

23890

RADIOISOTOPE TOXICITY: SIGNIFICANCE OF CHRONIC ADMINISTRATION. Miriam P. Finkel, Birute O. Biskis, and Patricia J. Bergstrand (Argonne National Lab., Ill.). p.461-73 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The most important characteristic of continuous exposure to radioactive isotopes is that the amount of material fixed in the body increases gradually until equilibrium is reached between the amount entering and the amount leaving. As a consequence, the radiation dose rate remains relatively constant with time at its maximum value, and there is the least possible variation in concentration from deposition site to deposition site. Several studies in progress do not support the thesis that the sequelae of internal irradiation are entirely a function of the total absorbed dose of radiation. The data of one experiment suggest that a large proportion of the osteogenic sarcomas that appear in a mouse population after a single injection of radiostrontium results from the radiation that is received at a maximum rate during the first week after injection. From another experiment it seems that a given amount of radiation delivered uniformly in time may be only one-third as carcinogenic in the mouse skeleton as the same total amount of radiation delivered at a maximum rate initially but at a slower rate as time goes on. The only correlations that have been made so far between acute and chronic exposures have applied to carcinogenesis. The response of a population in respect to life span shortening may be very different, or it may be entirely comparable. Examination of this point will require many more animals that have been exposed over a long period of time. An important corollary of dose-rate experiments is the investigation of the hypothesis that a response is elicited only after a threshold dose of radiation has been exceeded. This hypothesis enters into many considerations of the mechanisms by which ionizing radiations act upon living systems, and it is a critical point in evaluating dose-response relations at low exposure levels. It might be possible, by appropriate manipulations of fractionated injections, to determine whether or not a certain total dose of radiation delivered at a specific rate is required to induce malignant bone change. That this might be the case is suggested by the fact that the lower the total dose administered, the greater the difference in carcinogenic response between animals that received a single injection and those that received multiple injections of radiostrontium. In the same experiment the complicated response in respect to lymphocytic neoplasms also suggests that a minimum dose rate may be required for the direct induction of these tumors. An indirect induction of lymphomas is also indicated, and, since fractionation increased the number of these tumors at the lowest dose that was used, it is possible that a greater degree of fractionation might result in even more tumors. However, maximum fractionation, as obtained by continuous feeding, did not increase the number of lymphomas at moderate and low levels of exposure. It is emphasized that the hazard of chronic exposure to radioisotopes cannot be predicted directly from experience with acute exposure. Evaluations of the chance of injury from a contaminated environment should be based upon information gained from continuous exposure. (auth)

23891

RADIOISOTOPE TOXICITY: A CRITICAL REVIEW. V. P. Bond (Brookhaven National Lab., Upton, N. Y.). p.474-85 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Possible reaction mechanisms involved in the induction of neoplasia by ionizing radiations are discussed. The mechanisms are classified into four categories and hypotheses are presented. In these hypotheses it is necessary to separate what is termed the initiating event from its manifestations. The initiating event refers to the primary damage that may be done within a cell or cells, and the manifestation refers to the observed consequences of this damage or the neoplastic tissue. Data are reviewed which indicate that the problems of tumor induction by internally-deposited radioisotopes are extremely complicated. The need for additional research in this field is stressed. (C.H.)

Fallout and Ecology

23892 WT-1177

California. Univ., Los Angeles. School of Medicine. FACTORS INFLUENCING THE BIOLOGICAL FATE AND PERSISTENCE OF RADIOACTIVE FALL-OUT. R. G. Lindberg, E. M. Romney, J. H. Olafson, and K. H. Larson. Jan. 1959. 77p. Project 37.1 [of] OPERATION TEAPOT. OTS.

A study was made of the biological fate and persistence of radioactive fall-out relative to the physical characteristics of fall-out contamination, which varied with distance from Ground Zero (GZ). Special attention was given to the type of fall-out contamination on forage plants as representative of the internal emitters available to animals grazing in fall-out-contaminated areas. Data indicated that the activity associated with the plant samples collected from areas within the various fall-out patterns was predominantly the result of external contamination by radioactive fall-out particles less than 44 μ in diameter. The degree of plant contamination was a function of the mechanical distribution of the particles less than 44 μ in size within a distance of 100 miles from GZ, which was in turn influenced by such conditions of weapon detonation as tower height and meteorology. The radioactive fall-out material on plant foliage was persistent, as evidenced by the activity remaining on leaves after washing in Versene and $0.1\underline{N}$ HCl solutions and after mechanical shaking brought about by severe windstorms. An average of 21.6 per cent of the contamination on washed leaves was soluble in $0.1\underline{N}$ HCl, which suggests that a similar percentage of the fall-out material ingested by grazing animals would go into solution in the digestive tract. The tissue burdens of mixed fission products in animals sampled from fall-out-contaminated environments tended to decrease with distance from GZ in a manner similar to the degree of plant contamination. However, the beta activity per unit weight of femur tended to remain fairly constant to a distance of 140 miles from GZ. The thyroid showed a greater tissue burden of radioiodine at 60 miles than at either 12 or 140 miles from GZ. The relative decrease of total beta radiation in tissues of native animals serially sampled from the same fall-out-contaminated environment in most cases did not markedly deviate from the theoretical beta radioactive decay rate of mixed fission products ($t^{-1.2}$). The beta activity per unit weight of femur, however, gradually increased until 3 days postshot and then decreased. The thyroid activity continued to rise throughout the 15-day sampling period. I^{133} is believed to contribute largely to the thyroid burden during the first 3 days following the detonation. In all cases, animals with high activity in the gastrointestinal contents also had relatively high tissue burdens, whereas animals with low activity in the gastrointestinal tract had low tissue burdens. This suggested that ingestion was the principal source of fission products accumulated in tissues. The data further indicated that, in a population of animals grazing in a fall-out-contaminated environment, a rapid equilibrium between the absorbed activity and that passing through the gut may have been established within the first 2 days following fall-out. Data suggested that inhalation was a negligible path of uptake of fission products derived from weapons testing during, and for 12 hr immediately following, fall-out contamination. The accumulation of fission products by grazing animals was related to particle size, and, because the plant acted as a selective collector for very small fall-out particles, the intake of radioactive bomb debris by animals during grazing tended to be similar over a great distance and appeared to be independent of total residual fall-out. The amount of any specific fission product present in the environment is dependent in part upon the physical and chemical behavior of its parent during fall-out particle formation. Therefore, the amount of any specific isotope at any particular location within the fall-out pattern will be highly variable, and the occurrence of areas in which the biological accumulation of that isotope is high may be anticipated. (auth)

23893

ON THE DESORPTION OF RADIOACTIVE ISOTOPES OF CERTAIN REPRESENTATIVES OF AQUATIC INVERTEBRATES. A. B. Getsova (Inst. of Zoology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 133, 459-61 (1960) July 11. (In Russian)

The desorption of radioactive isotopes from mosquitoes (culex pipiens pipiens L.), caddis flies (Halesus interpunctatus Zett.), and mollusks (Aplexa hypnorum L.) was studied in order to determine the retaining time in live organisms after they are transferred from a contaminated media to clean water and also to find the effect of water soluble complex ethylenediaminetetraacetate (EDTA) on incorporated radioisotopes. The tests were made in lake-water-filled aquariums contaminated with Sr^{90}, Ru^{106}, Cs^{137}, and Ce^{144}. The results show that EDTA aids the adsorption process except for Sr^{90}. The uptake and desorption of radioactive isotopes is different for each aquatic invertebrate. The desorption of Sr^{90} is slowest in mosquitoes; Cs^{137} is the slowest in caddis flies; and Ce^{144} is the slowest in mollusks. An intensive adsorption of Sr^{90} and Ce^{144} was observed during the first 2 to 4 days, after which it was stabilized; desorption of Cs^{137} was much slower. In spite of a high percentage of desorption, the organisms carry a considerable amount of the radioactive substances into the clean water. (R.V.J.)

23894

AN ATTEMPT TO ANALYSE THE DISTRIBUTION OF RADIOISOTOPES IN NATURAL BIOGEOCENOSES. G. I. Makhonina, I. V. Molchanova, E. N. Subbotina, N. V. Timofeev-Resovskiĭ, A. A. Titlyanova, and A. N. Tyuryukanov. Doklady Akad. Nauk S.S.S.R. 133, 484-7 (1960) July 11. (In Russian)

Studies were made of chemical element migration and distributions in natural biogeocenoses. Tests were conducted in coniferous and leaf forests with the use of Fe^{59}, Co^{60}, Zn^{65}, and Ce^{144}. The data show the distribution of iron, cobalt, zinc, and cerium by the components of the biogeocenoses: the content of all elements in the surface biomass was counted in tens of percent and in the roots in per cent of the total content. The distribution in the soil layer was identical in all soils, but the migration differed according to terrain. Eighty-six percent of the cobalt was absorbed by the upper layer and about 1.8% between the 15 and 20 cm layer. Seventy-four per cent of the zinc was absorbed in the 0 to 5 cm layer and 2.5% in the 15 to 20 cm layer; Sixty-eight per cent of the cerium was absorbed in the 0 to 5 cm layer and 5.2% in the 15 to 20 cm layer. Iron proved to be the most mobile; 51.2% was absorbed in the 0 to 5 cm layer and 7.8% in the 15 to 20 cm layer. A table of distributions of various elements in various plants shows that larger concentrations of cerium are confined to the roots of all examined plants; four out of every 14 plants concentrated larger amounts of cobalt in the surface structures than in the roots; and five out of every 15 plants accumulated more iron in their upper structure than in the roots. However, of all the elements, zinc was accumulated in the plant surface structures to the greatest extent. (R.V.J.)

23895

ON THE MIGRATION OF RADIOACTIVE STRONTIUM IN BIOGEOCENOSES. N. A. Timofeeva (Inst. of Biology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 133, 488-91(1960) July 11. (In Russian)

The migrations of Sr^{90} in natural soil were observed for three years by using 3-mc Sr^{90} solutions placed at 2-cm and 5-cm depths in a 1.5 × 1.5 m area covered with grass. The content of Sr^{90} was measured in plants and soil at concentric peripheries of 0 to 5, 5 to 10, 10 to 15, 15 to 20, 20 to 25, 25 to 35, and 35 to 45 cm and in a 70-cm soil cross section taken vertically and horizontally every 5 to 10 cm. The results show a limited Sr^{90} migration from the initial spot. Moreover, the horizontal migration was twice the vertical. The faster horizontal migration is the result of transmission through the roots of plants. (R.V.J.)

23896

DETERMINATION OF Sr^{90} AND Cs^{137} IN SOIL AND PLANTS. P. Gaglione, A. Malvicini, and L. Vido (Comitato Nazionale per le Ricerche Nucleari, Ispra, Italy). Minerva nucleare 4, 155-61(1960) June. (In Italian)

The methods for the extraction and chemical separation of Sr^{90} and Cs^{137} from the soil and plants are described. The values for the Sr^{90} and Cs^{137} contents of a number of soil samples collected near the Ispra Nuclear Research Centre and that of samples of plants collected monthly from May to September 1959 are presented. For a long vegetation period, the values for the Sr^{90} discrimination factor from soil to plants are approximately 0.7. The values for the Cs^{137} concentration found in the examined plants demonstrate a direct absorption of this nuclide from the air as well as its absorption from the soil through the roots. (auth)

23897

RADIOCARBON FROM NUCLEAR TESTS. [PART] II. Wallace S. Broecker and Edwin A. Olson (Columbia Univ., Palisades, N. Y.). Science 132, 712-21(1960) Sept. 16.

As a result of nuclear testing, large amounts of radiocarbon are present in the earth's carbon cycle, specifically in the atmosphere. Measurements on simultaneously collected tree-leaf and atmospheric CO_2 samples show that the concentrations are often the same but that situations arise in which tree leaves give a lower value. A possible explanation for the discrepancy is that the leaves receive part of their CO_2 through the roots. For this reason, it seems that air-collected samples of CO_2 give the most reliable atmospheric $C^{14}:C^{12}$ ratio. Estimates of future distribution of bomb-produced C^{14} throughout the atmosphere-biosphere-ocean system were made. From the predicted inventories, combined with estimates of the future effects of combustion-produced CO_2, the $C^{14}:C^{12}$ ratios for the atmosphere and the ocean surface water can be predicted. (B.O.G.)

23898

STRONTIUM IN MAN AND BEAST. J. F. Loutit (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.117-26 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

A discussion is given concerning the course of strontium uptake in man and beast. Deductions and speculations are made on the adequacy of the animal as a human model. If these are valid, the important factors to determine for the prediction of Sr^{90} concentration in the bone are the average daily intakes of Sr^{90} and calcium. Determinations of stable strontium (${}^{5}Sr$) and the derivation of specific activity of Sr^{90}/Sr give indications of the degree to which they have equilibrated. On the basis of present-day observations on food and bone, a prediction is made for some of the values on which there are as yet no published data. (B.O.G.)

23899

RADIO-ACTIVE FISSION-PRODUCTS IN THE HUMAN FOOD CHAIN. J. F. Loutit (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.209-20 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

The discussion is concerned primarily with the fission-products from weapons and world-wide fall-out, rather than the contribution from reactors and their associated plants. The fundamental differences for the two sources are as follows: For weapons, there is instantaneous fission so that the fission products are a more or less predictable mixture of short, medium, and long-lived nuclides, and there is a deliberate release of the by-products. In the reactor, the fission process is continuous, thus the composition of the mixture varies with time; the fission-products produced in the reactor are not intentionally released to the atmosphere, and the hazards are confined to the local and moderately remote areas. Two of the longest-lived fission products are Sr^{90} and Cs^{137}, the oxides of which are water soluble so that when they contaminate food-stuffs they are readily taken into the body. The oxides of less long-lived products are insoluble in water or digestive juices, thus only minute traces of these, relative to strontium and cesium, are absorbed. (B.O.G.)

23900

RADIOISOTOPES IN SOILS: PARTICULARLY WITH REFERENCE TO STRONTIUM^{90}. Lyle T. Alexander (Soil Survey Lab., U. S. Dept. of Agriculture, Beltsville, Md.), Edward P. Hardy, Jr., and Hal L. Hollister. p.3-22 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The distribution of Sr^{90} is discussed on a global basis from the standpoint of soil measurements and resulting data obtained in various parts of the world. From the standpoint of detail, the picture is incomplete. However, enough data have been assembled to give a reliable picture of the broader aspect of Sr^{90} distribution in relation to latitude and rainfall. A more detailed picture of Sr^{90} distribution along two approximately constant rainfall lines in the United States has been obtained along with information on some hot spots in the United States. Other fission products in soils measured by gamma spectrometry are briefly discussed especially with regard to isotope ratios. (auth)

23901

RADIOISOTOPES IN SOILS: PHYSICAL-CHEMICAL COMPOSITION. R. O. Hansen (Univ. of California, Berkeley), Ramon Dios Vidal, and P. R. Stout. p.23-36 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The physical-chemical composition of radioelements in soils is as complicated as soil chemistry itself but with the added features of radioelements being transformed continuously into new elements. This is particularly evident with the uranium-thorium decay series. Soil chemistry may be considered from the point of view of a three phase system (gas, liquid, and solid). In the gaseous phase there is always radon and carbon dioxide which are radioactive. In the liquid phase there is some of every kind of radioelement occurring in nature along with all of the essential mineral elements which plants must extract from soils in order to grow. Of these latter the most important radioelement contributing to the activity of the biosphere is potassium. Carbon is second and tritium third in order. Nonessential elements, absorbed by plants and having analogous chemical reactions to essential elements, are rubidium, radium, uranium, and lead. These are present in ionic form in the liquid phase and consequently at equilibrium with adsorbed ions on the clay surfaces of soils. Thorium isotopes are so firmly adsorbed by soils that they may be considered more properly as part of the solid phase. In the solid phase proper there are to be found all of the radioelements of the uranium-thorium decay chains plus potassium and rubidium, which are held within crystals and inaccessible to the biosphere except through slow conversions by additional weathering. Advanced weathering results in resynthesis of soil minerals which includes substitutions of radioelements into the crystal structures where stable elements dominate. Zircon and monazite are silicate minerals and are among the last resistive minerals to remain during the process of soil weathering. Each of them contains isomorphically substituted uranium and thorium and by obvious implication, all of their daughter decay products. Because of these solid phase resistates, soils are never freed from radioactive isotopes, and intensely weathered soils having accumulated higher degrees of radioactivity than the parent rock from which they were derived are often found. Taking an average green crop as a measure of the amount of radioactivity derived from the soils and recycled annually in the immediate biosphere, it is noted that about .11 mc per annum per acre are involved. Thus, the annual turnover of labile radioelements by good croplands is about 70 mc per square mile. Interestingly, this figure compares rather directly with an 80 mc average for synthetic radioisotopes now distributed everywhere in the world. Questions of the role of these latter in the biosphere, however, call for a different set of chemical considerations in plant-soil-animal interrelationships perhaps more complex than for the naturally occurring radioisotopes. (auth)

23902

RADIOISOTOPES IN SOILS: EFFECTS OF AMENDMENTS OF AVAILABILITY. Ronald G. Menzel (Agricultural Research Service, Beltsville, Md.). p.37-46 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The effects of amendments on availability of Sr^{90} in the soil are rather small. Additions of lime, gypsum, fertilizers, or organic matter in practical doses usually reduce uptake by less than half. Only the addition of calcium-bearing amendments appears to affect the ratio of Sr^{90} and calcium in the plant products. Combinations of soil amendments and tillage practices can probably be worked out for specific soil conditions that will reduce uptake more than any single amendment would. The optimum use of soil amendments for maximum crop production may often coincide with their optimum use for reduction of Sr^{90} uptake. Amendments may have larger effects on the availability of other fission products, such as Ru^{106}, Cs^{137}, and Ce^{144}, but these fission products are normally less of a hazard than Sr^{90}. 26 references. (auth)

23903

RADIOISOTOPES IN SOILS: SOIL-PLANT RELATIONSHIP. Maurice Fried and W. R. Heald (Agricultural Research Service, Beltsville, Md.). p.47-59 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The uptake of ions by plants grown in soils is a dynamic process, involving both soil and plant factors. By evaluating all of these interdependent factors, particularly with reference to rates and mechanisms, soil-plant relationships can be understood and utilized. 68 references. (auth)

23904

RADIOISOTOPES IN PLANTS: ROOT ENTRY AND DISTRIBUTION. A. B. Hope (Univ. of Sydney). p.60-72 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Factors affecting the entry of ions into roots and the subsequent distribution in plants are reviewed. The uptake of various radioisotopes by plants is discussed. 29 references. (C.H.)

23905

RADIOISOTOPES IN PLANTS: FOLIAR ENTRY AND DISTRIBUTION. O. Biddulph (Washington State Univ., Pullman). p.73-85 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Foliar uptake and translocation studies with radioactive tracers have been conducted since about 1938. With the impetus of these techniques, foliar application of nutrients, growth substances, and systemic insecticides has become a very sizable endeavor. As a result this avenue of entrance into the plant is well known. Data showing the magnitude of fission product entrance through leaves into food chains is not available, but from the chemical nature of certain of the fission products and their fall-out characteristics their entrance via this channel can be anticipated. Strontium and cesium, when experimentally applied to leaves, have been found to enter readily. Foliar entrance into plants of materials in solution appears to be directly proportional to the amount applied and to the time period of absorption until crystallization of salts occurs on the leaves. The entering materials leave the leaf via the phloem in proportion to the amount applied to the leaf. The proportionality factor for phosphorus is approximately 1,000 times greater than that for calcium. A proportionality factor for potassium appears to be 2 to 3 times that for phosphorus. In a general way cesium appears to be treated similarly to potassium and strontium linearly to calcium within the plant so that strontium, foliarly absorbed, remains largely within the leaf which absorbs it; whereas cesium is largely translocated to other parts of the plant. Foliar absorption of fission products contributes radioactivity to food chains in excess of the calculated values based on laboratory determinations of discrimination factors. Foliar uptake could contribute significantly to the plant's total radioactivity. What may actually be contributed may depend heavily on the growth habits of the plant and on the existing weather conditions during the effective absorption period. 32 references. (auth)

23906

RADIOISOTOPES IN PLANTS: PRACTICAL ASPECTS OF AERIAL CONTAMINATION WITH STRONTIUM^{89} AND CESIUM^{137}. L. J. Middleton (Agricultural Research Council Radiobiological Lab., Wantage, Berks, Eng.). p.86-96 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Factors which may affect the absorption of fission products by the aerial parts of plants in the field are reviewed. Radiation hazards from the absorption by plants of fall-out fission products are discussed. 23 references. (C.H.)

23907

RADIOISOTOPES IN PLANTS: ABSORPTION AND INCORPORATION OF CARBON^{14} IN CELL METABOLISM. Martin Gibbs (Cornell Univ., Ithaca, N. Y.). p.97-109 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Although it appears that the main entry of carbon into the plant cell appears to occur as CO_2, the role of the HCO_3^- and $CO_3^=$ are still unknown. On thermodynamic grounds the plant cell would appear to possess at least 4 or 5 enzymes catalyzing the entry of carbon into its metabolism. In the light the carboxylation of ribulose diphosphate would appear to be the preferred mechanism. In the dark the main port of entry is still an open question with the carboxylation of phosphoenolpyruvate being logical. When carboxylation has occurred, it would seem that ATP and reduced pyridine nucleotide generated by the photochemical reaction act together in reducing the carboxyl group to the aldehyde level of oxidation. (auth)

23908

RADIOISOTOPES IN SOILS AND PLANTS: A CRITICAL REVIEW. A. G. Norman (Univ. of Michigan, Ann Arbor). p.110-19 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

When considering the fall-out problem, attention should not be limited to radiostrontium. There is a need for much more information on cesium, and there is particular merit in considering radiostrontium and cesium together in matters involving soil-plant relationships, plant composition, and the subsequent transfer of radionuclides to animals and man. In the transfer of isotopes to plants through the root system, soil chemistry is dominant. Much of what has been incorrectly called discrimination is a soil phenomenon or soil attribute. There are some opportunities for minimizing the radioisotope burden of plants by management practices, but the magnitude of the changes in content that can be accomplished is not impressive. Radionuclides in plants present us with no peculiarities. Foliar entry of radionuclides is a well established phenomenon and the extent of the isotope burden, derived in this manner, in the several plant parts is determined by very complicated interacting factors. It is especially important to consider both strontium and cesium when dealing with these questions. What may appear to be discrimination may arise from differences in mobility or redistribution. (auth)

23909

GENETIC CONTROL OF PHYSIOLOGICAL PROCESSES: CONSIDERATION OF DIFFERENTIAL ION UPTAKE BY PLANTS. W. M. Myers (Rockefeller Foundation and Indian Agricultural Research Inst., New Delhi, India). p.201-26 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Differences among species in content of important elements, in their absorption through roots and foliage, and in their transport from roots to aerial parts have been reported by many investigators. Data on chemical composition must be interpreted with caution since composition is influenced so much by factors of environment, stage of maturity of the plant, and plant part analyzed. Nevertheless, there is little doubt that some of the differences among species are attributable to the species themselves, i.e., to their genetic constitution. The somewhat more limited data on variations within species further substantiates the conclusion that genetically controlled differences do exist in content of various elements and in physiological processes involved in their uptake, transport and metabolism. 86 references. (auth)

23910

RADIOISOTOPES AND ENVIRONMENTAL CIRCUMSTANCES: THE PASSAGE OF PAIRS OF ELEMENTS THROUGH FOOD CHAINS. H. A. Kornberg (General Electric Co., Richland, Wash.). p.255-68 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Factors that affect the passage of pairs of elements through food chains are reviewed. Results are summarized from a series of studies on the relation of strontium to calcium in biological systems. Emphasis is placed on the effect of calcium levels on strontium-90 uptake and deposition in plants and animals. The effect of potassium levels on cesium-137 deposition and of chlorine levels on iodine-131 deposition are also considered briefly. Problems involved in attempts to estimate the hazards of fall-out contamination from ratio data are discussed. It is predicted that studies on pairs of elements and pairs of similar molecules will be useful in elucidating some of the fundamental processes involving biological transport systems. (C.H.)

23911

RADIOISOTOPES AND ENVIRONMENTAL CIRCUMSTANCES: THE PASSAGE OF FISSION PRODUCTS THROUGH FOOD CHAINS. R. Scott Russell (Agricultural Research Council Radiobiological Lab., Wantage, Berks, Eng.). p.269-92 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

When fission products are deposited on agricultural land the contamination of plant tissues, or other agricultural produce, may be due either to direct deposition on leaves, stems, or surface roots of plants and subsequent absorption or to the uptake by plants of fission products that are incorporated in the soil. Mechanisms involved in both direct and soil uptake of fission products by plants are discussed. An attempt is made to make an appraisal of the rate at which fission products may enter into food chains under natural conditions. Available information is summarized on the effects of continuous deposition of fission products, as would occur in world-wide fall-out, or sudden deposition of short duration as would occur in a reactor accident or close to ground zero after the detonation of a nuclear weapon, on subsequent levels of radioactivity in food chains. Tabulated data are included on the content of strontium isotopes in the human diet in the United Kingdom during 1958. The relative importance of the rate of fall-out and the cumulative total in determining the extent to which strontium-90 and cesium-137 enter the food chains is discussed. Other factors which may influence the rate of plant absorption of fission products are considered briefly. 44 references. (C.H.)

23912

RADIOISOTOPES AND ENVIRONMENTAL CIRCUMSTANCES: REDUCTION OF THE HAZARD IN THE FOOD CHAIN. B. B. Migicovsky (Animal Research Inst., Canada Dept. of Agriculture, Ottawa). p.293-305 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Experiments are described which indicate that strontium and cesium can be removed from milk without altering the flavor or the cation composition of the milk. The simplest treatment is that of a single treatment with equilibrated resin, e.g., CaKNa. This resin can be regenerated with equilibrating solution. In this case only 55 % would be removed in one treatment and about 70 % in two treatments. A pair of mixed resins would remove 85 to 90 % of the strontium. The mixed resins are more efficient because some of the strontium is bound and is not available for exchange onto an equilibrated resin. (auth)

23913

RADIOISOTOPES AND ENVIRONMENTAL CIRCUMSTANCES: A CRITICAL REVIEW. Arthur H. Wolff (Public Health Service, Washington, D. C.). p.331-6 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Criteria for evaluation of the hazards of radioisotopes in the biosphere are based upon the recommendations on maximum permissible levels (MPL) of the National Committee on Radiation Protection (NCRP) and the International Commission on Radiological Protection (ICRP). A quantitative interpretation of the biological significance of low levels of exposure is neither available today nor likely to be clearly available for many years. Prudent public health practice demands that we have standards and that they are interpreted and applied correctly. The NCRP and ICRP recommendations provide a satisfactory baseline for such standards. However, judicious interpretation is necessary for their application as general population values. Ecological factors must be considered before the significance of given levels of radioactivity in the environment can be interpreted within the framework of the ICRP or NCRP recommendations. Examples are cited as a background for this statement. (C.H.)

23914

RADIOISOTOPES IN THE SKELETON: A CRITICAL REVIEW. James S. Robertson (Brookhaven National Lab., Upton, N. Y.). p.423-8 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The consequences of the internal deposition of fall-out products, chiefly Sr^{90}, in human beings are discussed. Topics covered include bone structure, isotope distribution, radiation dose determination, and biological effects. Methods for the determination of total radioactivity in the skeleton are reviewed and applications in the determination of Sr^{90} are considered. It is pointed out that in 1956 the Sr^{90} concentration in children was ten times that in adults. Relatively more labeled material is deposited in the nonexchangeable matrix in children than in adults, but it is released sooner from children. Apparently, a given quantity deposited will do less harm in children than in adults. Data on bone-tumor formation induced by internally deposited radioisotopes in experimental animals are reviewed. The need is stressed for research on effects of the chronic administration of low levels of Sr^{90} and other bone seekers on long term biological effects such as life shortening, ageing, and other degenerative disturbances. (C.H.)

23915

RADIOISOTOPE ABSORPTION AND METHODS OF ELIMINATION: NUTRITIONAL CONSIDERATIONS. R. C. Thompson (General Electric Co., Richland, Wash.). p.514-25 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Hazards from the ingestion of fall-out radioisotopes after their entry into the food-chain are considered. Data show remarkably similar bone levels of Sr^{90} in samples collected throughout the world. The influence of diet on the intake of radioisotopes is considered negligible. The possibilities of eliminating certain foods from the diet and eliminating radioisotopes from certain foods are considered. Data are presented from a study on the effect of dietary calcium levels on the comparative metabolism of Sr^{90} and Ca^{45} in rats. It is concluded that on a world scale, in terms of large population averages, dietary patterns do not greatly affect the hazard from fall-out radioisotopes, and the alteration of dietary patterns does not offer a promising approach to combatting the hazard. (C.H.)

Radiation Effects on Living Tissues

23916 A/AC.82/G/L.399

Tokyo Univ. Botanical Inst.

EFFECTS OF RADIATIONS ON MITOSES STUDIED BY TRADESCANTIA TEST *IN VIVO*. I. X-RAY IRRADIATIONS BY SMALL DOSES. Bungo Wada. May 1960. 9p.

Effects of x-ray irradiations by small doses on mitotic cells were studied by Tradescantia tests *in vivo*. A considerable number of chromosome bridges were obtained in staminal hair cells of Tradescantia irradiated by 2 r, 4 r, and 8 r x rays. Biological significance of results obtained in *in vivo* observations was discussed in comparison with those in fixed preparations. (auth)

23917 A/AC.82/G/R.231

Československá Akademie Věd. Biofyzikdlne Ústa, Brno.

DAMAGE OF THE LIVER CELL PRODUCED BY A SMALL DOSE OF RADIATION. Milan Šilha. [1955?]. 4p.

An experiment is described in which it was shown that doses as small as 25r damage the liver cells of white mice. The damage is detectable as the acceleration of the coagulation of the incubated homogenate. (W.D.M.)

23918 NP-9032

Ohio State Univ. Research Foundation, Columbus.

THE INFLUENCE OF IRRADIATED FOODS ON THE ENZYME SYSTEMS CONCERNED WITH DIGESTION. Progress Report for August 16, 1959—March 15, 1960. R. O. Moore. Mar. 15, 1960. 31p. RF Project No. 748. Contract DA-49-007-MD-787.

The rat-feeding program that was initiated in December 1958 continued through two periods of digestion trials, a digestion trial with rats at 40 days of age and a second digestion trial when the rats were approximately 9 months of age. The irradiated diets were fed continuously throughout the period. Purified diets were employed in which the carbohydrate, protein, or fat and all combinations thereof were irradiated at one of two irradiation levels; this results in the use of 27 different diets. Digestion coefficients were determined for carbohydrate (starch), protein (casein), and fat (corn oil). Irradiation of starch at 3×10^6 or 6×10^6 mrad reduces the digestibility of starch. The irradiation of protein has no influence on the digestibility of protein or the digestibility of other components of the diet. The irradiation of fat did not affect the digestibility of fat when measured at 40 days of age, but did reduce digestibility of fat after being fed for 8 months. (auth)

23919 NP-9036
[Texas. Agricultural Experiment Station, College Station]. TO DETERMINE THE EFFECT OF IRRADIATION UPON THE WHOLESOMENESS OF FOOD. Progress Report No. 9 [for] Period: September 1959—March 1960. Elwood F. Reber, Om P. Malhotra, P. D. Beamer, and H. W. Norton. 15p. Contract DA-49-007-MD-72800.

Feeding irradiated beef to dogs had no significant effect on their growth, feed conversion, fertility, or lactation as compared to dogs fed nonirradiated beef. Feeding irradiated beef had no effect on the level of hemoglobin, red blood cell, white blood cell, or differential white blood cell counts. Feeding irradiated (5.58 megarads) beef depressed food consumption. There were fewer pups born to the dogs fed the 5.58 megarad-irradiated beef, but there were only two bitches per treatment. It is concluded that the significant depression of food consumption and the questionable depression of the size of litters born to dogs fed irradiated beef as observed in this project should be investigated further. Male rats fed irradiated beef were protected to a greater extent by the subcutaneous administration of vitamin K than by the oral administration of this vitamin. The administration of testosterone to intact rats fed irradiated beef increased the incidence of the hemorrhagic syndrome. (auth)

23920 NP-9037
Johns Hopkins Univ., Baltimore. McCollum-Pratt Inst. EFFECT OF HIGH LEVELS OF IONIZING RADIATION ON ANIMAL TISSUES. Progress Report No. 12 [for] September 1, 1959—February 29, 1960. Kenneth J. Monty. 4p. Contract DA-49-007-MD-631.

A brief report is given of exploratory experiments on carbonyl compounds as inhibitors of lipase, effects on fat absorption and transport, and carbonyl effects in plasmalogen biosynthesis. (T.R.H.)

23921 NP-9039
Industrial Bio-Test Labs., Inc., Northbrook, Ill. THE CARCINOGENIC PROPERTIES OF IRRADIATED FOODS. Progress Report No. 5 [for] Period: September 1, 1959—February 29, 1960. J. C. Calandra and John H. Kay. 16p. Contract DA-49-007-MD-895.

The possible carcinogenic properties of irradiated foods were studied by long-term feeding of mice. No significant body weight differences were found. The test has not progressed to the point where tumors may be expected. (T.R.H.)

23922 NP-9040
Oregon State Coll., Corvallis.
THE GROWTH, BREEDING, LONGEVITY AND HISTOPATHOLOGY OF RATS FED IRRADIATED OR CONTROL FOODS. Progress Report. Summary Report [on] ROOM TEMPERATURE STORED IRRADIATED CARROTS HISTOPATHOLOGY PORK FED ANIMALS. Edward C. Bubl, Joseph S. Butts, and Jesse F. Bone. Mar. 15, 1960. 14p. Contract DA-49-007-MD-580.

Four generations of rats were fed diets containing 35% dry solids of control or irradiated carrots. Although the data have not been statistically analyzed, gross treatment variations are not apparent with respect to growth, breeding, longevity, or hematology. The histopathology on the first generation pork-fed animals has been completed and is reported in detail. The most common cause of death was chronic progressive nodular pneumonia. The tumor incidence was not concentrated in one treatment or of one type. (auth)

23923 NP-9041
Miami. Univ., Coral Gables, Fla. School of Medicine. MOUSE CARCINOGENICITY STUDY. Progress Report for March 1, 1957—March 15, 1960. J. L. Radomski. 12p.

Tuna, sweet potatoes, fruit compote, beef, and corn irradiated to 5.58 megarads was fed to swiss, C3H, C57 black, and DBA mice to study carcinogenicity of oral ingestion. The incidence of tumors in the test animals and the controls was about the same. No carcinogenic effect is indicated. (T.R.H.)

23924 NP-9042
Miami. Univ., Coral Gables, Fla. School of Medicine. LONG-TERM DOG AND RAT FEEDING EXPERIMENT EMPLOYING IRRADIATED MILK AND BEEF STEW (C-RATION). Progress Report No. 6 [for] March 1, 1957 to March 15, 1960. William B. Deichmann. 14p. Contract DA-49-007-ND-785.

After 105 weeks of feeding evaporated milk and 105 weeks of feeding beef stew (C-Ration) to purebred beagle dogs, no toxic effects ascribable to either irradiated food were observed. All animals survived the experiment in good health and have now been sacrificed. Histopathological examination of their tissues is currently in progress. (auth)

23925 NP-9043
Saint Louis Univ. School of Medicine.
HEMORRHAGIC SYNDROME IN RATS FED IRRADIATED BEEF. Progress Report No. 3 [for] Period: September 1, 1959 to March 15, 1960. E. A. Doisy, Jr. and J. T. Matschiner. 10p. Contract DA-49-007-MD-996.

The data of previous work on the hypoprothrombinemic action of vitamin A esters are extended. A larger series of animals on more varied levels of vitamin A intake is studied. Animals fed fresh-beef diets are shown to be as resistant to hypothrombinemia as those fed casein. Preliminary data suggest that a feeding period of eight weeks may be necessary for maximal results. A high fat casein diet may prove useful in the assay of hemorrhagic agents. (auth)

23926 NP-9044
Virginia. Agricultural Experiment Station, Blacksburg. LONG-TERM DOG-FEEDING OF IRRADIATED AND CONTROL SHRIMP AND CARROTS (PHASE 1) AND NUTRITIVE VALUE OF IRRADIATED AND CONTROL PROTEINS (PHASE 2). Progress Report No. 6 [for] Period—6-Month Period Ending March 15, 1960. R. W. Engel, D. F. Watson, and W. F. Mestanza. 11p. Contract DA-49-007-MD-784.

When chymotrypsin is exposed to ethylene oxide gas under controlled conditions, much of its esterase activity is destroyed while little or no destruction of proteolytic activity occurs. More intense treatment with the fumigant results in complete destruction of esterase activity and partial destruction of proteolytic activity. These observations suggest possible separate functional sites on the enzyme. Since it is known that ethylene oxide inactivates the free amino acid, histidine, the present studies are concerned with attempts to establish what changes may have been induced in the histidine in the enzyme. Future studies will include an evaluation of ionizing radiation as it may influence esterase or proteinase activity in chymotrypsin. (auth)

23927 NP-9045
Georgia. Univ., Tifton. Georgia Coastal Plain Experiment Station.
GROWTH, REPRODUCTION, MORTALITY, AND PATHOLOGIC CHANGES IN DOGS FED GAMMA-IRRADIATED BACON FOR TWO YEARS. Final Report. M. W. Hale, W. F. Schroeder, and D. Sikes. Jan. 1960. 36p. Contract DA-49-007-MD-780.

The effects of feeding a partially irradiated diet to dogs for a period of two years were studied. The diet contained bacon at the level of 35% on a dry-weight basis. One group of animals received the control, unirradiated bacon which was maintained in a frozen condition prior to cooking, a second group received bacon irradiated at 2.79×10^6 rads, and a third group received bacon irradiated at 5.58×10^6 rads. Irradiated bacon was stored at room temperature (10 to 33°C) for periods of six months to one year prior to feeding. Data presented for these animals indicate no difference due to treatment with respect to growth, weight maintenance, hemoglobin, packed cell volume, white blood cell counts, reproduction, and lactation. (auth)

23928 NP-9046
Georgia. Univ., Tifton. Georgia Coastal Plain Experiment Station.
GROWTH, REPRODUCTION, MORTALITY, AND PATHOLOGIC CHANGES IN DOGS FED GAMMA-IRRADIATED CABBAGE FOR TWO YEARS. Final Report. M. W. Hale, W. F. Schroeder, and D. Sikes. Mar. 1960. 49p. Contract DA-49-007-MD-780.

The effects of feeding a partially irradiated diet to dogs for a period of two years were studied. The diet contained cabbage at the level of 20% on a dry weight basis. One group of animals received the control unirradiated cabbage which was maintained in a chilled condition prior to cooking, a second group received cabbage irradiated at 2.79×10^5 rads, and a third group received cabbage irradiated at 5.58×10^5 rads. Irradiated and control cabbage was stored at 4°C for periods of three to four weeks prior to feeding. Data presented for these animals indicate no difference due to treatment with respect to growth, weight maintenance, hemoglobin, packed cell volume, white blood cell counts, reproduction, and lactation. (auth)

23929 NP-9047
Medical Coll. of Virginia, Richmond.
LONG-TERM DOG FEEDING TESTS ON IRRADIATED GREEN BEANS AND FRUIT COMPOTE. Final Report. Paul S. Larson, H. B. Haag, J. K. Finnegan, R. Blackwell Smith, Jr., Gordon R. Hennigar, Lester F. Belter, and Edwin M. Crawford. [1959?]. 41p. Contract DA-49-007-MD-786.

Irradiated and nonirradiated green beans and fruit compote were added to the diet of purebred beagle dogs for a period of two years. No effects attributable to irradiated food are apparent as regards food consumption, growth measurements, feed efficiency, reproduction, hematology, or histopathology. A possible exception of unknown biological significance is a trend toward increased spleen weights. (auth)

23930 NP-9048
Wisconsin Alumni Research Foundation, Madison.
THE POSSIBLE CARCINOGENICITY OF IRRADIATED FOODS. This constitutes a Final Report. B. E. Kline and L. J. Teply. Dec. 30, 1959. 22p. Contract DA-49-007-MD-583.

Four hundred rats and thirty-seven hundred mice were fed, "painted," or injected with food preparations selected as being pre- or procarcinogenic and treated with levels of ionizing radiation which might be encountered in the radiation processing of foods. These tests did not demonstrate the production of a carcinogen by the irradiation treatment. (auth)

23931 NP-9081
New York. State Agricultural Experiment Station, Geneva.
A STUDY OF THE RADIATION-INDUCED SOFTENING OF PLANT TISSUES. Report No. 8 (Progress) for October 1—December 31, 1959. Z. I. Kertesz. 5p. Project No. 7-84-01-002. Contract DA-19-129-QM-1164.

The activation of respiration upon γ irradiation of apple tissue pieces (Rome Beauty) decreases with subsequent pickings from August to November. The respiratory response seems unrelated to initial firmness or radiation-induced softening of the tissue. (auth)

23932 NP-9088
Continental Can Co., Inc., Chicago.
COMPARATIVE RESISTANCE OF STRAINS OF CLOSTRIDIUM BOTULINUM TO IONIZING RADIATION. Report No. 6 (Progress) [for] Period: September 11, 1959 to December 10, 1959. J. M. Heinen. 7p. Project No. 7-84-01-002. Contract DA-19-129-QM-1214.

Spores of several strains of Cl. botulinum were processed and added to cans of beef stew which were irradiated to various degrees to produce partial spoilage. The mean D values (megarad) for types A, B, and E are 0.28, 0.23, and 0.16, respectively. Spore yields from type C have not been sufficient for testing. (T.R.H.)

23933 NP-9091
American Meat Inst. Foundation, Chicago.
A STUDY OF CHEMICAL CHANGES PRODUCED BY HEAT AND BY IRRADIATION IN MEAT AND MEAT FRACTIONS. Report No. 5 (Progress) for September 24, 1959—December 23, 1959. W. A. Landmann. 5p. Project No. 7-84-01-002. Contract DA-19-129-QM-1293.

Data from fractionation of phospholipids of irradiated meat and from paper chromatography of the fraction containing "wet dog hair" odor are presented. Results of various tests are given. (auth)

23934 TID-6217
Iowa State Univ. of Science and Technology, Ames. Veterinary Medical Research Inst. and Iowa State Univ. of Science and Technology, Ames. Inst. for Atomic Research.
EFFECT OF IONIZING RADIATION ON THE VIABILITY AND ANTIGENICITY OF PATHOGENS OF DOMESTICATED ANIMALS. Final Report [for] May 1, 1957—April 30, 1960. 26p. Project No. 10. Contract AT(11-1)-59. OTS.

Modifications to the Co^{60} irradiation facility and the performance of the facility are discussed. Gamma-inactivation rates were measured for Newcastle disease virus (NDV) present in allantoic and amniotic fluids harvested from infected chicken embryos under a wide variety of conditions. Studies indicate that vaccines produced by gamma-radiation inactivation of NDV in embryo allantoic fluids have a reasonably good immunizing potential and that some degree of temperature and/or state dependence exists. Tests at 3 and −13°C showed that the immunizing potential is retained through 8 and 14 hr, respectively. Studies on the temperature enhancement of the gamma effect in NDV–embryo allantoic fluid viral system were performed. Radiation sensitivity of the hemagglutinating property (HA activity) between different strains of NDV did not differ to any appreciable extent. Heat inactivation characteristics of various NDV strains showed that marked differences between strains existed. Studies on the hog cholera virus (HCV) revealed that when it is irradiated in the presence of swine serum and after the serum-virus system has absorbed 17.6×10^5 to 26.4×10^5 rads, the viable virus remaining is affected in some manner that delays its ability to infect swine with hog cholera for a period of 10 to 14 days after innoculation. This period appeared to be quite specific and was not modified by radiation up to 2.13×10^7 rads of total dose. (See also AECU-4238.) (C.J.G.)

23935 TID-6590
Johns Hopkins Univ., Baltimore. School of Hygiene and Public Health.
THE EFFECTS OF IONIZING RADIATIONS ON HELMINTH PARASITES. Annual Progress Report.
Everett L. Schiller. [nd]. 7p. Contract AT(30-1)-2481. OTS.

Progress is reported in study of transmission of x-ray effects to progeny, attempts to isolate a variant strain from eggs of x-irradiated individuals, and the relation between gross morphological effects and alterations in chromosome structure and configuration. (T.R.H.)

23936 HW-tr-17
THE GENETIC EFFECTS OF IONIZING RADIATION IN MAN. R. Turpin, J. Lejeune, and M. O. Rethore. Translated by Liz Appleby from Bull. schweiz Akad. med. Wiss. 14, 571-9(1958). 11p. JCL.

A study is described which sought to determine the radiation dose that would produce as many mutations in man as are spontaneously produced in the time interval between generations. Variation of masculinity after irradiation of the mother was studied from statistics of Hiroshima and Nagasaki victims and from French and American medical statistics. This "doubling" dose is estimated at 30 r. (T.R.H.)

23937 JPRS-2287(p.29-36)
MORPHOLOGIC CHANGES IN THE NERVE CELLS OF THE CEREBELLUM AFTER TOTAL-BODY AND LOCAL IRRADIATION OF WHITE MICE WITH X-RAYS. M. N. Sorokina. Translated from Tsitologiya 1, No. 4, 374-(?) (1959).

Results are reported from a study of the morphological changes in the nerve tissue of the cerebellum of adult mice; occurred after whole-body and local irradiation with x rays. It was concluded that the nerve tissue of the cerebellum is less radiosensitive than the motor nuclei of the medulla. (C.H.)

23938 JPRS-2287(p.37-48)
RULES AND REGULATIONS OF THE EFFECT OF IONIZING RADIATION ON HAPLOID YEASTS, ZYGOSACCHAROMYCES BAILII. V. I. Korogodin and Ai-sên Lu (Ay-shen' Lyu). Translated from Tsitologiya 1, No. 4, 379-(?)(1959).

Results are reported from a study of the effects of γ radiation on natural haploid yeasts of the species Zygosaccharomyces bailii. Factors involved in the post-radiation death of the haploid yeast are compared with factors involved in the death of irradiated diploid yeast. It is concluded that radioinduced inactivation of haploid cells is brought about chiefly through recessive lethal mutations. The effect of chromosome number on radiosensitivity of yeast is discussed. (C.H.)

23939 JPRS-2287(p.49-58)
THE PROBLEM OF THE RETENTION OF RADIATION INJURY IN EPITHELIAL CELLS OF CORNEAS OF FROGS IRRADIATED DURING HIBERNATION. I. B. Bychkovskaya. Translated from Tsitologiya 1, No. 4, 387-(?)(1959).

Radiation injuries in the epithelium of the corneas of frogs irradiated in a state of hibernation were manifest only after the animals awaken. Injury to corneal epithelium which developed in waking frogs after irradiation was much less pronounced if the irradiation was administered under anoxic conditions. (C.H.)

23940 JPRS-2287(p.74-80)
FREQUENCY OF CHROMOSOMAL REORGANIZATIONS IN TISSUES OF RADIOSENSITIVE AND RADIORESISTANT PEA PLANTS. V. V. Khvostova and L. V. Nevzgodina. Translated from Tsitologiya 1, No. 4, 403-(?)(1959).

A study of chromosomal reorganizations in the first mitoses of the rootlets of three varieties of peas showed that the greater the degree of radiosensitivity the more mitoses with chromosomal reorganizations were observed. Possible causes of different degrees of vulnerability of chromosomes are discussed. (C.H.)

23941

IONIZING RADIATIONS AND CONGENITAL ANOMALIES IN VERTEBRATE EMBRYOS. Robert Rugh and Erica Grupp (Columbia Univ., New York and Marine Biological Lab., Woods Hole, Mass.). Acta Embryol. Morphol. Exptl. 2, 257-68(1959).

Similar anomalies of the central nervous system may be produced in fish or mouse embryos as a result of x irradiation at certain stages of development. These stages include any time prior to the completion of neurogenesis, even so far back as the zygote. The anterior end of the fish or mouse embryo appears to be adversely affected by x irradiation, whether the exposure occurs during neurogenesis or even during the first cleavage prior to any neural differentiation. Thus, there appears to be a cephalic gradient of radiosensitivity, especially evident since the more posterior structures such as heart, lungs, and gastro-intestinal tract appear largely to be unaffected, no matter when irradiation occurs. X irradiation of the fish or mouse embryo does not produce uniform effects in all exposed individuals. Even within a single clutch of fish embryos or a litter of mice, there may be a wide variation in the effects of similar exposure to ionizing radiations. Nevertheless, the major effect is on the central nervous system and, whether or not a gross anomaly is produced, it is believed that every mouse embryo exposed to 50 r or more or every fish embryo exposed to 300 r or more will have neural deficiencies. These may be reflected in general stunting, microcephaly, or possibly even in functional reduction in behavior efficiency. There is evidence that the embryo attempts to maintain its topographical relations, even with the deficiencies due to irradiation during development, so that stunted animals result which appear to be rather normal in organ proportions. The lowest exposure to x rays which may cause permanent deficiencies has not yet been determined. Such data from fish and mouse embryos, even though they agree, cannot be safely extrapolated to the human. Nevertheless, they are suggestive that embryonic and fetal exposure of the human embryo should be avoided at all stages of development since neurological deficiencies may result. Human data of this sort are not available and until they are, caution is recommended in the use of ionizing radiations on human gonads and embryos, at least until direct data are contra-indicative. (auth)

23942

THE DIFFERENCES IN RESPONSE OF GRAFTED AND NORMAL SKIN TO IONIZING IRRADIATION: CLINICAL OBSERVATIONS. Philip Rubin and Jerry W. Grise (Strong Memorial Hospital, Rochester, N. Y.). Am. J. Roentgenol., Radium Therapy Nuclear Med. 84, 645-55(1960) Oct.

From the clinical observations presented, it can be concluded that differences in the pattern of response and recovery to ionizing irradiation occur in grafted skin sites. It is also apparent that there is a spectrum of response ranging from pronounced radiosensitivity to relative radioresistance. The reactivity is proportional to the age of the graft. (auth)

23943

THE INFLUENCE OF DELIVERY RATE OF WHOLE BODY 250 KV. ROENTGEN IRRADIATION (30 OR 3 ROENTGENS PER MINUTE) ON MICE, RATS AND GUINEA PIGS. Michael P. Dacquisto and Edward W. Blackburn (Walter Reed Army Inst. of Research, Washington, D. C.). Am. J. Roentgenol., Radium Therapy Nuclear Med. 84, 699-704 (1960) Oct.

Mice, rats, and guinea pigs were given whole-body roentgen irradiation with 250 kv at rates of 30 r/min and 3 r/min. The rat showed the most tolerance to low-rate roentgen irradiation with an increase of 38 per cent in the $LD_{50/30}$; the mouse $LD_{50/30}$ increased 14 per cent; the guinea pig was equally sensitive regardless of rate. This difference in response cannot be ascribed to accepted acute recovery rates for these species. (auth)

23944

BIOLOGIC EFFECT OF GRID COBALT 60 RADIATION. John W. Lane, Walter Mauderli, and David M. Gould (Univ. of Arkansas Medical Center, Little Rock). Am. J. Roentgenol., Radium Therapy Nuclear Med. 84, 781-6(1960) Oct.

In a recent clinical study a group of advanced cancer patients were treated with focused telecobalt grid therapy. The relative biologic effect of grid therapy compared to homogeneous irradiation was studied. White Swiss mice were exposed in comparable groups to homogeneous and grid cobalt 60 radiation. The ratio of the grid dose to the homogeneous dose required to produce a median 30 day lethality was found to be 2.4. This factor, however, was dependent upon total dose and varied from 2.9 at lower doses to 2.2 at higher doses. Analysis of mean survival times of the 2 groups of mice revealed a ratio of 2.5 at the LD 50/30 dose level. The volume dose for grid exposure was found to be 1.9 times less than that delivered by equal homogeneous doses. Thus, a sparing effect of grid irradiation was suggested by the discrepancy of the ratios of 1.9 and 2.4. The ratio of 2.9 is close to that found to be clinically effective in the clinical cancer study. (auth)

23945

EFFECTS OF IN VITRO RADIOCOBALT IRRADIATION OF RABBIT OVA ON SUBSEQUENT DEVELOPMENT IN VIVO WITH SPECIAL REFERENCE TO THE IRRADIATION OF MATERNAL ORGANISM. M. C. Chang and D. M. Hunt (Worcester Foundation for Experimental Biology, Shrewsbury, Mass.). Anat. Record 137, 511-19(1960) Aug.

Fertilized rabbit ova recovered one to six days after mating were irradiated in vitro from a radiocobalt source and then transplanted into recipient animals. When examined 22 to 28 days later 44, 33, 8 and 0% of ova irradiated respectively at 50, 100, 1,000 and 5,000 r developed into apparently normal fetuses without external or internal malformation. No significant differential sensitivity was apparent in ova irradiated at different ages. It was found further that 34, 36, 19 and 10% of two-, 4-, and 6-day ova irradiated respectively in vitro at 200, 400, 600, and 800 r developed into "normal" fetuses. Again no malformation of fetuses and no differential radiosensitivity between ova of different ages were observed. Following whole body irradiation at 400 r, it was found that 40% of non-irradiated ova developed into normal fetuses when transplanted into recipient animals that had been irradiated (vs. 36% in the irradiation of ova alone). However, only 17% of estimated ova developed into "normal" fetuses when pregnant rabbits were irradiated 2, 4 or 6 days after insemination (vs. 64% in the control). It appears that irradiation of the maternal organism influences embryonic development and that irradiation of pregnant animals exerts a combination of ill effects, on the ova and on their environment. Cytological study of irradiated blastocysts revealed no chromosomal breakage immediately after irradiation. Chromosomal abnormalities, fragmentation and condensation of chromatin were observed during the culture of irradiated blastocysts in accordance with the dosages applied. From this study it is concluded that (1) although 50 r may affect embryonic development, there seems to be no differential effect up to 400 r, above which greater prenatal death occurs; (2) before implantation, irradiated ova either die or develop into apparently normal fetuses and there is no evidence of differential radiosensitivity at various stages of development; (3) irradiation of the maternal organism alone also affects embryonic development; and (4) radiation damage affects a fundamental biological system which leads to the nuclear damage and failure of mitosis, and the death of ova. (auth)

23946

IMMUNOLOGICAL STUDIES OF MOUSE RADIATION CHIMAERAS. D. W. H. Barnes (Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.). Brit. J. Radiol. 33, 582-5(1960) Sept.

Immunological studies are reviewed which were made on mouse radiation chimeras. The immunological response of the recently formed chimera and the long-lived homologous and heterologous chimeras are discussed. (C.H.)

23947

LYMPHOID TISSUE REPLACEMENT. H. E. M. Kay (Royal Marsden Hospital, London). Brit. J. Radiol. 33, 585-7 (1960) Sept.

Experimental data concerning the transfer of lymphoid cells and the possible bearing on clinical situations are reviewed. (C.H.)

23948

CONSIDERATION OF THE THEORY OF BONE MARROW GRAFTING AS TREATMENT OF RADIATION DAMAGE. L. G. Lajtha (Churchill Hospital, Oxford). Brit. J. Radiol. 33, 588-92(1960) Sept.

It appears that any dose of a single whole-body radiation that would allow survival of the organism with marrow grafting would also allow recovery of the remaining marrow elements without need for marrow grafting if careful substitution therapy is used. There appears to be no prima facie case for marrow grafting either following irradiation or following treatment with tumor-chemotherapeutic agents. Careful sterile nursing, antibiotic treatment, and frequent platelet transfusions are likely to prevent fatal accidents following damage to the marrow and thus allow time for spontaneous regeneration. This time, furthermore, may be shortened by early stimulation of the marrow elements as indicated by experiments on animals. It may sound incongruous to advocate a series of massive venesections immediately following irradiation, but the theoretical possibility that it may stimulate regeneration of all marrow elements does exist. Animal experiments could easily furnish the necessary proof. (auth)

23949

Co^{60} RADIATION-INDUCED PHENOTYPIC MUTATION OF SOIL BACTERIA. Nganshou Wai and Li-Tse Ou. Bull. Inst. Chem., Acad. Sinica No. 2, 1-28(1960) Feb. (In English)

The mutagenous effect of ionizing radiation of Co^{60} on living cells was demonstrated in irradiated bacteria. The expression of phenotypic mutation was determined on four conditions, namely, the change of dimensions of cell size, the textures of giant colonies observed under visible light, the fluorescence of giant colonies observed under ultra-violet ray of 366 mμ wave length, and the production of amino acids in the culture media. Nine strains of soil bacteria including Bacillus brevis, Bacillus megatherium, Bacillus circulans, Bacillus pumilus, Micrococcus candidus and Brevibacterium erythrogenes were used as the test organisms. In general, the morphological mutation was obviously induced in the rod-shape bacteria. Among them Bacillus pumilus, particulary, was sensitive to the effect of radiation. Under the dosage of 5000 roentgens the irradiated bacillus produced daughter cells of one-fourth to one-half the parent size. No reversion was observed in the clones of such smaller organisms even after many transfers. The morphological mutations have been proved to be reproducible. (auth)

23950

CARCINOMA OF THE MAXILLARY SINUS FOLLOWING THOROTRAST INSTILLATION. Report of 3 Cases. Morton Kligerman, Raffaele Lattes, and Robin Rankow (Columbia Univ., New York). Cancer 13, 967-73(1960) Sept.-Oct.

Three cases of carcinoma of the maxillary sinus 10, 18, and 21 years after the instillation of thorium dioxide (Thorotrast) into the maxillary sinus are reported. Histologically, one was an adenocarcinoma, one was a squamous cell carcinoma, and one was a mucoepidermoid carcinoma. A cause and effect relationship between the substance used and the production of the cancer appears highly probable. These cases add to the existing accumulated evidence that Thorotrast or other related radioactive substances should not be used as a diagnostic medium since their persistence in the form of colloidal particles in the tissues over long periods represents a definite hazard for a possible carcinogenic effect. (auth)

23951

THOROTRAST-INDUCED CANCER IN MAN. Renato Baserga, Hidejiro Yokoo, and George C. Henegar (Northwestern Univ., Chicago). Cancer 13, 1021-31(1960) Sept.-Oct.

The case history is presented of a malignant tumor in man attributed to the injection of Thorotrast. 55 references. (C.H.)

23952

SOME DELAYED EFFECTS OF ATOM-BOMB RADIATIONS IN MICE. A. C. Upton, A. W. Kimball, J. Furth, K. W. Christenberry, and W. H. Benedict (Oak Ridge National Lab., Tenn.). Cancer Research 20, No. 8, Pt. 2, 1-60(1960) Sept.

The relative biological effectiveness of atomic-bomb radiations was compared with that of the same dose of neutrons and gamma rays absorbed at conventional dose rates. Approximately 5000 mice were exposed to graded amounts of atomic-bomb radiation following placement at various distances from the hypocenter of an atomic explosion. The mice were observed throughout their lives for delayed somatic effects such as changes in vigor, longevity, and cause of death. Results are tabulated and illustrated with 91 photographs. The effects observed in this study did not differ from those observed following exposure to radiations delivered at a high intensity from conventional laboratory sources. The results of this experiment demonstrate that instaneous exposure to penetrating radiations sets in motion a complex series of changes culminating in premature onset of diseases of natural senescence and life shortening. 180 references. (C.H.)

23953

INACTIVATION OF SUSPENSIONS OF TISSUES HAVING PROTECTIVE ACTION AFTER RADIATION. Jiri Soska. Českoslov. biol. 7, No. 1, 30-4(1958). (Translated from Referat. Zhur. Biol. No. 3, 1959, abstract No. 13372)

Irradiated mice were injected intravenously with a suspension of cells of the spleen, and regeneration of the spleen tissue was observed. This suspension lost activity from heating at 56°C, from irradiation higher than 100 to 200 r, from lypholization of the spleen, and from freezing and thawing. Inactivation occurred both with its irradiation and with irradiation of mice from the spleen of which the suspension was prepared. Viable cells were the effective component of the tissues of the suspension that demonstrated a protective action.

23954

COAGULATION OF HOMOGENIZED CYTOPLASM AS A REACTION TO RADIATION. Milan Silha. Českoslov. biol. 7, No. 1, 60-1(1958). (Translated from Referat. Zhur. Biol. No. 3, 1959, abstract No. 13371)

Homogenized cytoplasm of the spleen and liver, separated from the nuclei by centrifugation, coagulated after several hours of incubation in vitro if it was taken from rats that were irradiated with 25 r for 30 min before sacrifice. A homogenate, that was derived from non-irradiated rats during the same time interval and prepared in the same manner did not coagulate.

23955

EFFECT OF INDOLEACETIC ACID AND OF THE EXTRACT OF YEASTS ON THE RESTORATION OF THE POLIFERATION POWER OF CULTURES OF CROWN-GALL TISSUES OF SCORSONERA IRRADIATED WITH X RAYS. Robert Jonard. Compt. rend. 251, 588-90 (1960) July 25. (In French)

Indoleacetic acid, even at strong concentrations, does not restore the proliferation powers of cultures of crown-gall tissues of Scorsonera that were irradiated with 1000 r x rays (output 100 r/min). On the contrary, an appreciable restoration is noted with an extract of yeast of $^1/_{1000}$. (tr-auth)

23956

THE COMPARATIVE MUTAGENIC EFFECT OF ETHYLENIMINE, ULTRAVIOLET AND X-RAYS. S. I. Alikhanyan and N. I. Zhdanova (All Union Research Inst. of Antibiotics, USSR). Doklady Akad. Nauk S.S.S.R. 133, 454-6(1960) July 11. (In Russian)

The mutagenic effects of ethylenimine were determined by the use of Actinomyces alivaceus (the product of B_{12} vitamin) and compared with ultraviolet, and x ray effects. The spores were exposed to high concentrations of ethylenimine (solution of 1:1000) for various times (30 min, 1, 2, 3, 4, and 5 hr) and to diluted concentrations (1:3000, 1:4000, 1:5000, 1:6000, 1:7000, 1:8000, 1:9000, and 1:10,000) for 24 hr. The maximum mutagenic effect is produced by short-time exposure to a concentrated solution; lethality at various treatments is nearly identical. The results of the comparison with ultraviolet and x rays indicate a large advantage in the use of ethylenimine. Curves of reverse mutation frequencies indicate prevailing frequencies of ethylenimine mutations over ultraviolet. This shows that regardless of genetic background changes, the advantages of ethylenimine are retained. (R.V.J.)

23957

ON THE TWO KINDS OF RADIATION AFTER-EFFECT OBSERVED IN BARLEY SEEDS. N. I. Shapiro and E. M. Bocharova (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 133, 462-5(1960) July 11. (In Russian)

The thermal after-effects and their relation to the oxygen after-effects in barley seed with radioinduced chromosome aberrations were studied at 16 to 18° and 53°C. The seed were exposed to 10 kr; some were wet at room temperature and some at 53°C; others were wet at room temperature and 53°C, and simultaneously exposed to oxygen. The results show that an increase in temperature increases the chromosome aberration frequency. An "oxygen" effect is evident at both temperatures, indicating that oxygen does not inhibit thermal effects. (R.V.J.)

23958

ELECTRON-OPTICAL RESEARCH ON SMALL-INTESTINE EPITHELIAL CELLS AFTER X IRRADIATION. H. Braun (Universität, Freiburg i. B.). Exptl. Cell Research 20, 267-76(1960) Aug. (In German)

Electron-optical studies were conducted on small-intestine epithelium of white mice after whole-body irradiation of 450 r. Changes were observed in the structure of the mitochondria, the endoplasmic reticulum, and the nuclear membrane. Regeneration of the endoplasmic lamella always occurs in direct contact with the regenerating mitochondria. (tr-auth)

23959

DEVELOPMENT OF X-RAY INDUCED GIANT HeLa CELLS. L. J. Tolmach and P. I. Marcus (Univ. of Colorado, Denver). Exptl. Cell Research 20, 350-60(1960) Aug. (In English)

HeLa S3 cells increase in volume and mass exponentially without lag following doses of 1200 or 1300 r of 230 kv x rays. Growth proceeds at a rate about half of normal for 6 days, then more slowly until about 12 days when growth ceases. The distribution of individual cell sizes broadens during the growth period. Spontaneous loss of these cells from a glass surface may be characterized grossly by an exponential decay function with a 3 to 5 day half time; more detailed analysis indicates that the irradiated population consists of two fractions which have half times for persistence of 1 to 3 days following a lag of about 2 days (60 to 80%) and 5 to 15 days (20 to 40%), respectively. The more persistent fraction may enter a phase of rapid decay after about 16 days. Methods are described to obtain large-sized pure populations of x-ray induced giant HeLa cells with average volumes 20 to 40 times normal. (auth)

23960

ACTION OF CHLORAMPHENICOL ON THE CHANGE IN CAPACITY OF ESCHERICHIA COLI B CELLS IRRADIATED WITH X-RAYS FOR PHAGE T 3. F. Herčík (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 269-76(1960). (In English)

The capacity of irradiated Escherichia coli B cells for phage T 3 in the presence of chloramphenicol was investigated. When added at the same time as phage, chloramphenicol caused a marked decrease in capacity, particularly when added during the logarithmic phase of growth. Irradiation of E. coli B cells prior to infection likewise caused a marked reduction in capacity. On adding chloramphenicol together with phage to irradiated bacteria during the logarithmic phase, the decrease in capacity was relatively smaller, however, than might have been expected if the deleterious effect of the two factors were cumulative. In stationary cultures the protective effect of chloramphenicol was less marked. In both cases the inactivation curve was biphasic in character. (auth)

23961

THE SIGNIFICANCE OF THE INTENSITY OF METABOLIC PROCESSES AND OF WEIGHT FOR THE RADIOSENSITIVITY OF THE ORGANISM. L. Novák and M. Pospíšil (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 277-86(1960). (In English)

The authors studied the correlation between the radiosensitivity of rats irradiated with a single whole-body exposure of 600 r, weight, and the values of metabolic processes measured prior to irradiation. The existence of a relation between radiosensitivity and weight and between both these functions and the intensity of metabolic processes was confirmed. In a detailed analysis of differences between animals in the same weight group which survived and those which died, it was found that in the lower weight groups, metabolic values were higher in animals which died, whereas in the higher weight groups, they were lower in those which died. The significance of metabolic activity for the development of radiation injury is discussed. (auth)

23962

RADIOSENSITIVITY AT SPECIFIC AUTOSOMAL LOCI IN MATURE SPERM AND SPERMATOGONIAL CELLS OF DROSOPHILA MELANOGASTER. Mary L. Alexander (Univ. of Texas). Genetics 45, 1019-22(1960) Aug.

The mutation rate, when calculated with point mutations, was higher in mature sperm than the rate for spermatogonia with 900 r of x radiation. The higher rate in sperm shows a difference in the mutational sensitivity of the two types of cells. Selection of chromosome breakage types from spermatogonia cannot account for the difference. The spermatogonial mutants show the same proportion of viable and lethal mutations as obtained with mature sperm with 900 r. The absence of chromosome aberrations remained characteristic of spermatogonial mutants. (auth)

23963

IMMEDIATE AND EARLY REACTIONS TO X RAYS. R. Brinkman. J. belge radiol. 43, 282-93(1960). (In French)

The immediate or very early reactions of living elements to irradiation were studied. Admitting that the radiological effect on the molecule can be observed when a sufficient number of molecules have been elaborated on this same pattern, experiments on the effect of radiations on nucleoproteins, lipoproteins, and mucoproteins are described, and some interpretations of the viscosity of the synovia, which is lowered by irradiation, and of the problems of protection are given. (auth)

23964

THE RESPONSE OF TETRAHYMENA PYRIFORMIS TO IONIZING RADIATION: STRAIN SPECIFIC RADIOSENSITIVITIES. Carolyn Wells (Oak Ridge National Lab., Tenn.). J. Cellular Comp. Physiol. 55, 207-19(1960) Apr.

Four clonal strains, HS, EU 6000, EU 6001, and EU 6002, of T. pyriformis were exposed to x-ray doses ranging from 48 to 333 kr. After irradiation single cell isolations were made. Survival was measured as the ability of these single cell isolates to form macroscopically visible colonies. By this technique it was found that some of these strains are more radioresistant than others. Certain events between treatment and termination of the experiment (either by death or survival of the cell lines) were studied. Cytological studies of irradiated cells show certain micronuclear abnormalities not observed in controls. All 4 strains were analyzed biochemically. The most radioresistant strain, HS, had only half as much total DNA per cell as the more radiosensitive EU strains. The RNA content was equivalent. Certain interpretations of radiation sensitivity differences are excluded by the data. The radiosensitivity of the strain is not correlated with the ploidy of the micronucleus. Also, no correlation can be made with the total DNA content of the strains. These and other points are discussed showing that interpretations based on differences in target multiplicity are not compatible with the results. It is suggested that radiosensitivity differences are related to differences in ability of the strains either to protect against radiation damage or to repair damage that has been done. A choice between these interpretations is not allowed by the present data. (auth)

23965

CHANGES IN CHRONAXIA IN RATS AFTER RADIATION. PRELIMINARY REPORT. Konrad Szymczykiewicz, Stainslaw Gross, and Jozef Sysa. Med. Pracy 9, No. 1, 53-5(1958). (Translated from Referat. Zhur. Biol. No. 3, 1959, abstract No. 13403)

With total x irradiation of rats with doses of 50, 100, and 400 r, motor chronaxia of the rear extremity significantly increased proportionally with the dosage, but the rheobasis was not changed.

23966

ON MYELOPOIESIS DURING CHRONIC ACTION OF LOW DOSES OF IONIZING RADIATION. V. V. Sokolov and I. A. Gribova (Inst. of Industrial Hygiene and Occupational Disease, Academy of Medical Sciences, USSR). Med. Radiol. 5, No. 7, 10-14(1960) July. (In Russian)

A study was made of the bone marrow and peripheral blood in persons subjected to the chronic effect of low doses of ionizing radiation. With a normal quantity of leukocytes and transitory leukopenia, no considerable changes were observed in the granulocytic series of the bone marrow. In the majority of patients with stable leukopenia, an increase was seen in the number of young cells of the granulocytic series at the expense of maturation disturbance at the myelocyte-promyelocyte stage. In a number of cases leukopenia occurred at the expense of decreased total content of granulocytes as a result of reduction of the mitotic activity of young cellular forms. No pronounced changes of the erythroblastic and megacaryocytic series were noted. (auth)

23967

THE EFFECT OF RADIOACTIVE CESIUM (Cs^{137}) ON THE HUMAN ORGANISM. M. N. Fateeva, V. S. Klimov, A. I. Ponizovskaya, N. I. Gorbarenko, V. V. Sokolov, and M. I. Smirnova. Med. Radiol. 5, No. 7, 14-19(1960) July. (In Russian)

An accidental affection with radioactive cesium is described. Data are given of dynamic observations of the effect of radioactive cesium on the organism, its content therein, the dynamics of radioactivity decreases, its concentration in the blood and discharges, and its excretion with the urine. The peculiarity of this case lies in the fact that the changes in the human organs and systems developed slowly; no acute or subacute period was observed, this apparently being due to the low dose of the incorporated element. (auth)

23968

RETARDED GROWTH OF BONES OF THE FOREARM IN A GIRL FOLLOWING RADIUM THERAPY OF SKIN HEMANGIOMA. T. D. Mirimova. Med. Radiol. 5, No. 7, 19-22 (1960) July. (In Russian)

A 9-month-old girl was subjected to radium therapy of skin hemangioma in the region of the forearm. Thirteen years afterwards there was revealed a considerable impairment in the growth and development of long bones that were within the field of the irradiation, resulting in the formation of a deformed shortened hand with restricted functions. (auth)

23969

AN EXPERIMENTAL ANALYSIS OF THE CONDITION OF THE THYROID GLAND IN CHRONIC IRRADIATION OF THE ORGANISM. E. A. Lyalin (Central Scientific Inst. of Medical Radiology of the Ministry of Health, USSR). Med. Radiol. 5, No. 7, 37-42(1960) July. (In Russian)

The influence of chronic irradiation on the thyroid gland was studied. The state of the process of secretion of the intrafollicular colloid, as well as the ability of the thyroid tissue for proliferation, was investigated by introducing methylthiouracil into the organism. The hormone content in the gland was determined by biological testing on Rana temporaria. The functional activity of the thyroid gland was assessed by the absorption of indicator doses of I^{131}. It was shown that thyroid gland proliferation in conditions of chronic irradiation is reduced in comparison with the control. The process of intrafollicular colloid secretion becomes impaired during chronic irradiation. Although the ability to absorb I^{131} is almost unchanged, the hormone synthesis in chronic irradiation becomes considerably disturbed. (auth)

23970

THE COURSE OF RADIATION SICKNESS AND THE STATE OF THE SECRETORY FUNCTION OF THE INTESTINE IN DOGS IN THE EMPLOYMENT OF DIETS WITH A QUALITATIVELY DIFFERENT FAT COMPOSITION. M. F. Nesterin and V. N. Chukaeva (Inst. of Dietetics, Academy of Medical Sciences, USSR). Med. Radiol. 5, No. 7, 42-5 (1960) July. (In Russian)

Studies were made of the effect of x rays on the state of the secretory function of the intestine in dogs with isolated portions of the intestine (after Tyree) against a background of diets with a qualitatively different fat composition. Suet, sunflower oil, sourcream, and fat enriched with arachidonic acid were used. The fat content comprised 30% of the caloricity. Disturbance of the secretory process of the intestine in dogs following irradiation was marked to a lesser extent in animals given diets with sourcream and fat enriched with arachidonic acid. (auth)

23971

THE EFFECT OF RADIATION ON VITAMIN B_1 METABOLISM. Iori Ueno (Univ. of Kyoto). Med. Radiol. 5, No. 7, 45-51(1960) July. (In Russian)

Investigations were made of the influence of radiation on the changes in the blood level of vitamin B_1 and changes of vitamin B_1 excretion in urine. (auth)

23972

ELUCIDATION OF THE CHEMICAL NATURE OF PEROXIDE COMPOUNDS, FORMED IN THE PROCESS OF RADIATION FACTOR ACTION. E. M. Pandre (Inst. of Research in Sanitation and Chemistry, Ukrainian S.S.R.). Med. Radiol. 5, No. 7, 51-4(1960) July. (In Russian)

A study was undertaken with the purpose of elucidating the chemical nature of oxidants formed in the tissues of animals during x-ray irradiation and to assess the processes involved in the formation of these oxidants. (auth)

23973

THE SENSITIVITY OF ANIMALS TO INFECTION WITH THE CULTURE AND TOXIN OF PERFRINGENS, AND THE EFFECTIVENESS TO IMMUNIZATION WITH THE ANATOXIN IN RADIATION AFFECTION. L. M. Shmuter (Epidemiological-Sanitation Station, Lugansk, USSR). Med. Radiol. 5, No. 7, 63-6(1960) July. (In Russian)

Experiments were staged on mice irradiated with a 300 r dose. Irradiation of the animals before the introduction of the antigen depresses the immunogenesis. The first antigen injection causes no production of antibodies, and the natural resistance of animals to the action of the toxin under the effect of irradiation is reduced by almost 50%. After the second antigen injection the artificial immunity of the irradiated animals rises considerably; however, it is lower than in the control animals by 1.6 times. Irradiation of the animals following immunization not only completely removes the worked-out immunity, but also reduces the natural resistance of white mice to the toxin of perfringens by 50%. (auth)

23974

SOME EFFECTS OF GAMMA RADIATION ON PLANT TRANSPIRATION. H. J. M. Bowen and P. A. Cawse (Wantage Radiation Lab., Berks, Eng.). Radiation Research 13, 395-402(1960) Sept.

Doses of γ radiation from 12.5 to 100 krad have a marked transient effect on the transpiration rates of intact tomato plants. When tomato shoots are irradiated alone with the roots shielded, the transpiration rate is decreased; but when the roots are irradiated with the shoots shielded, the rate is slightly increased. At doses of 50 krad and above, whole plants give a transpiration curve which shows both these effects since the rate first decreases, then increases again, and finally settles down at a value lower than the initial one. Some hypotheses are advanced which could explain these results. (auth)

23975

THE ACTION OF FAST CARBON AND HEAVIER IONS ON BIOLOGICAL MATERIALS. I. THE INACTIVATION OF DRIED ENZYMES. G. W. Dolphin and Franklin Hutchinson (Yale Univ., New Haven). Radiation Research 13, 403-14 (1960) Sept.

Experiments are described on the inactivation of the dry enzymes β-galactosidase and trypsin by carbon, oxygen, and fluorine ions with an energy of 10 Mev/AMU. The results are intelligible if one considers the ionization produced by a heavy ion to consist of a heavily ionized track, which inactivates everything through which it passes and a surrounding cloud of δ-electrons, the density of which varies as the square of the charge on the ion. The biological effect of the δ-electrons can be calculated on the assumption that a single ionization produces inactivation of a single molecule either by Lea's associated volume method or by a method worked out in the paper. The good agreement between theory and experiment is impressive evidence for the validity of target theory for this case and shows that no additional mechanism for inactivation by these heavily ionizing particles needs to be invoked. (auth)

23976

EFFECT OF GRADED ACUTE EXPOSURES OF GAMMA RAYS OR FISSION NEUTRONS ON SURVIVAL IN SUBSEQUENT PROTRACTED GAMMA-RAY EXPOSURES. J. F. Spalding, V. G. Strang, and F. C. V. Worman (Los Alamos Scientific Lab., N. Mex.). Radiation Research 13, 415-23(1960) Sept.

Five hundred and twenty-eight female mice were randomly divided into twelve groups and given fractionated doses of γ rays ranging from 240 to 1200 rads and fission neutrons ranging from 92 to 451 rads. After a repair period of 90 days, they were placed in a continuous field of γ rays where they remained until death. The mean accumulated dose for each group was determined and correlated with the insult dose. The results of this study showed that (1) radiation-induced damage in the mouse has one component that is permanent and irreversible, (2) at least a fraction of this irreversible damage is proportional to the magnitude of the insult dose and is measurable in terms of a reduction in survival time in a continuous γ-radiation field, and (3) the fraction of permanent injury produced by fission neutrons is approximately five times as great as that produced by γ rays. A comparison of the results of this study with other experiments of a similar nature was made. (auth)

23977

TRACE ELEMENT CONTENT OF THE SPLEENS OF RATS AFTER TOTAL-BODY X-IRRADIATION. Kenneth B. Olson, Carl F. Edwards, George E. Heggen, Abbott S. Weinstein, Leonard B. Clark, and Margaret Kaulfuss (Albany Medical Coll., N. Y., Saratoga Springs Commission Research Labs., N. Y. and Union Coll., Schenectady, N. Y.). Radiation Research 13, 424-31(1960) Sept.

Five trace elements, phosphorus, iron, zinc, manganese, and chromium, have been found consistently at 4, 8, and 12 days after irradiation in the spleens of rats receiving total-body irradiation in doses of 200, 400, and 600 r. Nickel, copper, and molybdenum were also studied but were not found consistently by the method used and in the sample size available. All the trace elements analyzed increased in concentration, and significant variations were found with phosphorus, iron, and manganese and to some extent with chromium. Zinc concentration increased, but owing to sample variation the changes could not be shown to be significant. The total content of phosphorus fell significantly. Zinc content decreased, but most of the changes again could not be shown to be significant, owing to variation. Iron increased in total content by a significant amount, and manganese and chromium increased to some extent, but these changes were only occasionally significant. Alterations in concentration and content of the elements studied usually reflected the dose of radiation administered. (auth)

23978

THE RELATIVE BIOLOGICAL EFFICIENCY OF 20-MEV ELECTRONS AND 180-Kvp X-RAYS IN ESCHERICHIA COLI INACTIVATION. Irving Leskowitz, J. G. Van Dyke, J. S. Laughlin, and J. J. Nickson (Sloan-Kettering Inst., New York). Radiation Research 13, 445-51(1960) Sept.

The RBE of 20-Mev electrons as compared with 180 kvp x rays was determined from dose-survival curves for E. coli B/r, irradiated in the resting state. Absorbed doses produced by the 180-kvp x rays were measured with the Fricke ferrous sulfate dosimeter on the basis of Victoreen chamber measurements with correction and conversion factors applied as described. The absorbed dose of electrons was determined with the Fricke ferrous sulfate dosimeter and a G value of 15.5 molecules of ferric ion produced per 100 ev. The RBE was determined to be 0.82 ± 0.01 with E. coli B/r. (auth)

23979

SIMILARITIES IN THE EFFECTS OF OXYGEN AND NITRIC OXIDE ON THE RATE OF INACTIVATION OF VEGETATIVE BACTERIA BY X-RAYS. P. Howard-Flanders and P. Jockey (Univ. of California, Berkeley). Radiation Research 13, 466-78(1960) Sept.

The effect of oxygen and nitric oxide on the sensitivity to x rays of the bacillus Shigella sonnei was investigated. The experiments were carried out with the bacillus in aqueous suspension and under conditions favorable for the precise control of the amount of dissolved gases present during irradiation. It was found that in regard to effect on radiosensitivity in this system, nitric oxide was equivalent to oxygen, molecule for molecule. The solubility of nitric oxide is about 50% greater than that of oxygen, so that a lower partial pressure in the gas phase was needed. It was found that 1.6 μM of either gas sufficed to double the radiosensitivity and that the concentration of oxygen required did not depend on temperature between 2° and 30°C. Nitric oxide also increased the radiosensitivity of haploid yeast and was not toxic to either organism at temperatures below 15°C. The properties of the gas are summarized. The hypothesis that the gases act by reacting with a carbon radical formed by the radiation at some point in a molecule that is essential to the cell for successful multiplication is discussed. (auth)

23980

THE EFFECT OF ZIRCONIUM CITRATE ON THE LATENT PERIOD OF Sr^{89}-INDUCED BONE CANCER IN MICE. Gloria E. Zander-Principati and Joseph F. Kuzma (Marquette Univ., School of Medicine, Milwaukee). Radiation Research 13, 489-95(1960) Sept.

A large cancerogenic dose of Sr^{89} was given intraperitoneally to virgin female CF$_1$ mice. The tumor-inhibiting effect of zirconium citrate was determined by changes in the incidence and latent period of bone tumors. Early intraperitoneal administration of zirconium citrate after injection of Sr^{89} lengthened the latent period of osteogenic sarcoma, especially when repeated injections of zirconium citrate were given. Lowered incidence of tumors in some groups given zirconium citrate was not statistically significant. 22 references. (auth)

23981

SURVIVAL OF GUINEA PIGS AFTER LETHAL IRRADIATION AND HOMOLOGOUS BONE MARROW INJECTIONS. Stanley A. Rosenthal, Leonard C. Harber, Rudolf L. Baer, and Milton Friedman (New York Univ. Post-Graduate Medical School, New York and University Hospital, New York). Radiation Research 13, 496-501(1960) Sept.

The lethal effect of whole-body x irradiation was studied in a group of 299 heterozygous English short-haired male albino guinea pigs. These animals received graded doses of 450, 600, 675, 750, 825, or 900 r. The LD$_{100(15)}$ days was found to be 675 r. By using homologous bone-marrow transfusions after lethal whole-body irradiation in 168 guinea pigs, by doses ranging from 675 to 900 r, a 30-day survival of 12 to 21% (median 18.5%) was achieved. This heterozygous group of guinea pigs in general was unable to survive skin homografts from the donor of the bone marrow immediately after whole-body x irradiation. However, in the two animals surviving these three procedures for several weeks, the skin homografts also survived. (auth)

23982

WEIGHT VARIATION OF ORGANS OF ALBINO RATS WHOLE-BODY IRRADIATED AND PROTECTED WITH DOSES AND DIFFERENT TREATMENTS OF CYSTEAMINE. U. Nuvolone and M. L. Tognacca (Università, Messina, Italy). Radiobiol. Latina 2, 301-10(1959) Oct.-Dec. (In Italian)

A study was made of changes in body weight and in the weight of heart, liver, spleen, kidney, adrenal glands, and testis in normal albino rats treated with high doses of cysteamine and in rats protected with different doses of cysteamine administered in different ways before 600 r whole body irradiation. Prolonged administration of cysteamine inhibits growth of body weight, which is resumed immediately after treatment is stopped. A retardation of the resumption of growth in body weight was observed in irradiated animals protected with 3 mg of cysteamine before irradiation; in the case of animals treated for 8 days (6 mg pro die in two doses) before irradiation the resumption of growth was slower. Prolonged treatment with cysteamine did not produce detectable weight changes in the heart, liver, or testes; but a considerable weight loss occurred in the spleen and adrenals. Administration of a single 3-mg dose 15 min before irradiation protected the spleen and the adrenals in different ways and by different mechanisms. (auth)

23983

CORTICO-ADRENAL FUNCTIONALITY IN IRRADIATION AND ITS RELATION TO RADIATION DAMAGE. R. Bossi, M. Lupo, U. Nuvolone, and G. Pisani (Centro Studi di Radiobiologia e Cancerologia, Istituto Radiologico dell'Ospedale Maggiore, Novara, Italy). Radiobiol. Latina 2, 321-46(1959) Oct.-Dec. (In Italian)

After a review of the literature on radiation sickness, especially that concerning the reaction of the adrenal cortex, observations are reported on a group of cancer patients treated with x ray or cobalt therapy. Mainly, steroiduria of 11 OC, 11 DC and 17 KS, the level of blood eosinophils, and the Thorn test were studied. During irradiation there was a remarkable increase, proportional within certain limits to the integral dose, in the urinary excretion of 11 OC and 11 DC, which was in some cases associated with an altered Thorn test. This association was observed in the cases that showed severe radiation sickness. Cases of true adrenocortical exhaustion were never seen. It was concluded that the clinical aspects of radiation sickness can only partially and in certain cases be related to the adaptation syndrome. The most important indices for the study of adrenocortical function are the Thorn test and the urinary excretion of 11 OC and 11 DC. The eosinophils are subject later on to extrahormonal influences, whereas the 17 KS are only a secondary expression of corticosteroid catabolism. (auth)

23984

DEVELOPMENT OF WALKER TUMORS IN RATS EXPOSED TO FOCUSSED X RAYS PROTECTED AND NOT PROTECTED WITH CYSTEAMINE. S. Greco (Università, Catania, Italy), G. Pisani, U. Nuvolone, and M. Tognacca. Radiobiol. Latina 2, 347-72(1959) Oct.-Dec. (In Italian)

A study was made of the protective action of cysteamine on the growth of the Walker tumor subcutaneously grafted in the thoracic region of 48 Long-Evans rats after local irradiation with 1000 and 2000 r. The protection was evaluated by two methods. These were a volumetric method measuring the daily increase in tumor diameter and a cytological method counting the number of mitoses per unit area and the nuclear index. It was established that cysteamine has a clear-cut protective action in the sense that the increase in tumor size after irradiation was within the limits of that seen in the non-irradiated animal but differed sharply from that in the irradiated non-protected animal. (auth)

23985

SIMPLE METHOD TO INDUCE MUTATIONS WITH TRITIATED WATER. Fernando Avanzini, Luciana Cieri, and Giordano Giacomello (Università, Rome). Ricerca sci. 30, 891-3(1960) June. (In Italian)

A simple method which uses β radiation from tritium in tritiated water is outlined. The method can be used for either spores or microörganisms in various development stages. The results obtained with Penicillium chrysogenum XXXIV S are given. (J.S.R.)

23986

INVESTIGATION OF CHANGES PRODUCED IN HENS' EGGS AFTER LONG-TIME IRRADIATION WITH RADIOACTIVE Co 60. M. Dobes. Sborník Českoslov. akad. Zeměděl. věd., Vet. med. 4, 245-50(1959). (Translated from Referat. Zhur. Khim. No. 22, 1959, abstract No. 80238).

The irradiation of fresh hens' eggs with Co^{60} rays for 18 weeks produces a change in the color of the white and the formation of white bodies in the latter. The yolk becomes separated from the white by a dense layer of protein substances. An electrophoretic investigation of these substances established their difference from the protein substances in fresh eggs. (auth)

23987

EFFECT OF TOTAL RADIATION BY ROENTGEN RAYS ON HIGHER NERVOUS ACTIVITY OF DOGS. N. Ya. Lipatov, F. P. Mayorov, and B. V. Pavlov (Inst. of Physiology, Academy of Sciences, USSR). Trudy Inst. Fiziol. im. I P. Pavlova 6, 310-21(1957). (Translated from , Referat. Zhur. Biol. No. 3, 1959, abstract No. 13401)

X irradiation by fractionated doses of 12.5 r with a total dosage of 150 r and doses of 25, 50, and 100 r with the total dosage 300 and 600 r evoked changes in the higher nervous activity of dogs. After application of the same dose to one dog, the conditioned reflexes increased, and only after a month and a half did they begin to recede. In others a decrease of reflexes began at the time of irradiation or immediately after it without the phase of elevation. However, in all the dogs there occurred a weakening of the processes of stimulation and inhibition. With irradiation with total doses of 300 and 600 r in all cases along with a decrease in the intensity of conditioned reflexes there were observed hypnotic phases (compensating, paradixical, and sometimes ultraparadoxical). In all the series unconditioned reflexes increased after total irradiation.

23988

"TOXIC" SUBSTANCES APPEARING IN THE BLOOD OF ANIMALS AFTER IONIZING RADIATION. N. N. Kuznetsova (Inst. of Genetics, Academy of Sciences, USSR). Trudy Inst. Genet., Akad. Nauk S.S.S.R. No. 24, 446-51 (1958). (Translated from Referat. Zhur. Biol. No. 3, 1959, abstract No. 13388)

One hour after total x irradiation with 1500, 2000, and 4000 r, blood was taken from 53 donor mice, citrated, and 0.2 ml was injected intravenously into recipient mice. Leukopenia was never observed, but there was always a leukocytosis. Negative results were also obtained when horse and mouse serum irradiated with 10,000 r in vitro was injected into mice. With the injection of 0.2 ml of blood from animals irradiated with 1500, 2000, and 4000 r the number of blood platelets rose. Injection of blood from nonirradiated animals produced a depression of platelets. With subcutaneous injections of 0.4 ml of serum from mice irradiated with 1000 r the results were comparable with data obtained with transfusions of citrated blood. It is suggested that "toxic" substances are formed with the irradiation of animals and with the action on serum in vitro.

23989

INHIBITION AND STIMULATION OF BIOLOGICAL ACTIVITY OF VITAMINS OF GROUP B BY MEANS OF ROENTGEN RADIATION. D. Mucke and A. Morczek. Vitamine u. Hormone 8, No. 1, 34-41(1958). (Translated from Referat. Zhur. Biol. No. 3, 1959, abstract No. 13397)

With irradiation of thiamine, riboflavin, niacin, biotin, choline, and PABA in crystalline states to a dosage of 5 to 500 r, there was no detection of biological activity as determined by the influence of each of the vitamins on the growth of fungi cultures (respectively), Neurospora crassa ATCC 9185, Y 30539, 4540, Allescheria boydii 1699, Neurospora crassa 34486 and 1633). With approximately the same doses, irradiation of these same vitamins in weak aqueous solutions at a pH of 5.0 to 5.2 led to a significant decrease in their biological activity, irradiation in a nutrient medium solution optimal for each fungus intensified the biological activity of thiamine, choline, and PABA, as was manifested in their fortified stimulation of the growth of the corresponding cultures. Using the same amount of radiation on plain nutrient medium and medium to which the specified vitamins were added, the stimulatory effect was absent.

23990

REACTIVITY OF ORGANISM WITH TOTAL RADIATION OF ANIMALS BY ROENTGEN RAYS (DATA ON STUDY OF CARBOHYDRATE METABOLISM). S. A. Akopyan and T. G. Arutyunyan. Voprosy Rentgenol. i Onkol. (Erevan) Sbornik 2, 201-9(1957). (Translated from Referat. Zhur. Biol. No. 3, 1959, abstract No. 13376)

Dogs and rabbits were subjected to total x irradiation (600 and 700 to 1000 r, respectively). At various intervals the stages of carbohydrate metabolism were determined. Preliminary injection of insulin sharply increased the radiosensitivity of the animals. All the rabbits died the 2nd or 3rd day after irradiation. In irradiated animals the injection of insulin produced a sharper drop in the sugar level than in the controls. The reaction to insulin was not always accompanied by convulsions, even with a drop in the sugar level to 25 mg %. Injection of small doses of adrenaline into the irradiated animals gave a more pronounced hyperglycemia than was present before irradiation. Plotted sugar curves indicated that the ascent of the sugar level in irradiated animals was not as sharp and rapid as in the nonirradiated but the return of the sugar content to normal occurred sooner.

23991

CHANGES IN SOME ENZYMES IN EXPERIMENTAL RADIATION SICKNESS. S. G. Shukuryan. Voprosy Rentgenol. i Onkol. (Erevan) Sbornik 2, 223-7(1957). (Translated from Referat. Zhur. Biol. No. 3, 1959, abstract No. 13396).

Applicators with Co^{60} were attached to the heads of rabbits, exposing them to a total dosage of 55,000 r. Blood was taken from the ear vein before irradiation and from the 4th to 30th day after irradiation. Catalase activity was determined by the Bach technique and carbonic anhydrase by the Brinkman method with the modification of Kreps. The carbonic anhydrase index was established by the erythrocyte count. Inactivation of catalase was observed after 3 to 4 days, was increased on the 8th to 16th day, and toward the 30th day its activity was gradualy restored. Activity of carbonic anhydrase fell as early as the 2nd day, was in-completely restored later on, and toward the 30th day was low. In younger rabbits, 2 to 3 months old, the activity of catalase and carbonic anhydrase persistently fell till the animals died. With a total dosage of 40,000 r the activity of catalase and carbonic anhydrase dropped until the 8th day and normalized later on. With total irradiation with Co^{60} (total dose 900 r) the activities dropped sharply, and death occurred earlier.

23992

EFFECTS OF X-IRRADIATION ON EMBRYOS AT CRITICAL STAGES OF HEART DEVELOPMENT. W. M. Copenhaver, Rhoda H. Van Dyke, and Roberts Rugh (Columbia Univ., New York). Yale J. Biol. and Med. 32, 421-30(1960) June.

Embryos of Amblystoma punctatum were x irradiated at Harrison's stages 26, 30, and 34. These are critical stages of heart differentiation, ranging from the time when the primordial endocardial cells separate from splanchnic mesoderm to the time when the heart attains a tubular form and begins to contract. The x-ray exposures ranged from 100 to 10,000 r. Following x irradiation, the embryos were reared at a temperature of 12 to 13°C. Non-irradiated controls were kept at the same temperature. In general, the amount of developmental retardation was proportional to the total amount of x irradiation and inversely proportional to the degree of differentiation at the time of exposure. In all of the series studied, there was a latent period between exposure to x irradiation and the appearance of developmental defects. The embryonic central nervous system and eyes were particularly radiosensitive. Microcephaly developed in a high percentage of embryos exposed at the early experimental stages. Cardiovascular anomalies developed in all embryos exposed to 250 r or above at stage 26 and in all embryos exposed to 500 r or above at stages 30 and 34. With high doses differentiation was so retarded that the embryos never developed circulation. With intermediate doses circulation developed for a period, only to fail subsequently. The pulsation rate remained approximately normal for a considerable period after the magnitude of contraction had decreased. Stasis in vessels of the liver and yolk was common. Since the heart anomalies occurred together with other malformations, further studies are in progress to determine how much abnormal cardiac structure and function results directly from radiation of the embryonic heart and how much is dependent on total-body x irradiation. (auth)

23993

RADIATION DOSE—MACROSCOPIC, MICROSCOPIC AND SUB-MICROSCOPIC ASPECTS. L. H. Gray (Mount Vernon Hospital, Northwood, Eng.). p.1-14 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

The effects of radiation on a cell or a tissue are dependent on the radiation absorbed by the cell and independent of the radiation that passes through the cell. The energy defined by the absorbed dose is imparted to matter in the form of energy transfer between moving charged particles and electrons. The absorbed energy is usually about equally divided between ionization and excitation. In the analysis of dose response relationships of biological materials, consideration must be given to the fact that energy is not delivered uniformly to matter but discontinuously along the tracks of individual ionizing particles. (B.O.G.)

23994

LEUKAEMIA INDUCED BY RADIATION. J. F. Loutit (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.15-25 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

During the last generation, the incidence of leukemia in the populations of Western Europe and the United States has increased at a steady rate to more than double its former value. There is now abundant evidence that exposure to ionizing radiation does cause an increased incidence of leukemia. The future state of affairs can be predicted only if there are reliable laws on which to base the predictions. According to certain published statistics, when all classes of leukemia are lumped together, there is an uneven distribution of incidence with age. An early mode occurs in childhood; in the 20-40 year age range, incidence is minimal, after which it increases with each decade. The work done on the inbred mouse strain, CBA, is discussed. (B.O.G.)

23995

EFFECTS OF WHOLE-BODY IRRADIATION ON THYMUS FUNCTION AND LYMPHOCYTE HOMEOSTASIS. Donald Metcalf (Walter and Eliza Hall Inst., Royal Melbourne Hospital, Melbourne). p.26-9 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

Kaplan showed that in mice the induction of leukemia is by an indirect mechanism. The thymus plays a major role in this indirect process. A thymectomy, performed either before or after irradiation, substantially reduces the subsequent incidence of leukemia. Stimuli, arising from the irradiated tissues, appear capable of affecting the degeneration-regeneration cycle in the thymus and determine whether or not neoplasia occurs in this organ. Following irradiation, the thymus was shown to influence the appearance of leukemia in the other lymphoid tissues by a non-cellular influence produced by the thymus. Metcalf has shown that the thymus produces lymphocytosis stimulating factor (LSF) and that in lymphoid leukemia, both in humans and mice, excessive levels of LSF are present. (B.O.G.)

23996

RADIATION QUALITY AND BONE-MARROW DOSE IN RADIOLOGY. J. H. Martin and G. Muller (Peter MacCallum Clinic, Melbourne). p.30-6 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

A study was made of radiation conditions with regard to quality and quantity within the field of radiation and outside it in regions to which radiation can be scattered. An assessment is made of the bone-marrow dose with a consideration of the changes in radiation quality as it penetrates a scattering medium such as the body. An investigation is made of the possibility of a linear relationship between the incidence of leukemia and dose. The corrections made for the absorption of radiation by the bony shell surrounding the bone marrow vary greatly with the radiation energy in the range of interest. (B.O.G.)

23997

SOME EFFECTS ON LYMPHOID CELLS OF OCCUPATIONAL AND ACCIDENTAL EXPOSURE TO IONIZING RADIATIONS. D. O. Shiels. p.37-46 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

Numerous authorities suggest that the earliest sign of the effects of ionizing radiation on the blood is a reduction in white cell count or in the lymphocyte count. The object here is to show that certain other changes are more sensitive and more consistent indications than either of these. (B.O.G.)

23998

SELECTIVE IRRADIATION AND ATTEMPTED REPLACEMENT OF BONE MARROW IN THE RABBIT, USING ^{198}Au. J. M. Garvan, E. P. George, F. A. Rocke, and S. Vince (St. Vincent's Hospital, Darlinghurst, New South Wales). p.56-67 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

In the main investigation of rabbits, colloidal Au^{198} was chosen as the source of irradiation because its incorporation into the bone marrow should give maximum discrimination in favor of irradiation of the marrow rather than the bone; subsequent bone-marrow transfusion with minimum damage from residual radio-activity can be made earlier, owing to its 2.7 day half life; and problems of radiometric assay of specimens are simplified because of the emitted γ radiation. The merits of using P^{32} as the source are discussed. The results show that it is possible to selectively irradiate the bone marrow to a degree that produces severe or even complete aplasia and that this can be readily achieved without producing any detectable radiation damage to other organs. This is made possible by the relatively high uptake of the colloid in the marrow (it is roughly half the administered dose) and by the fact that almost all the remaining dose is taken up by the liver, a relatively radio-sensitive organ. (B.O.G.)

23999

EXPERIMENTS IN HOMOGRAFT SURVIVAL. M. Kent (Univ. of Melbourne). p.68-72 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. M. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

The subject of homotransplantation is introduced and the influence of total body irradiation on the mechanisms of the homograft reaction is discussed. An interim report on work conducted with rabbits of different skin colors is described. A graft was recorded as rejected at the first signs of hardness, which is the first difference noted between the homograft and its autograft control. Results are tabulated which show the length of time of homograft survival in rabbits irradiated prior to skin grafting. (B.O.G.)

24000

SECONDARY RADIATION DISEASE FOLLOWING HETEROGRAFTING. Peter Ilbery (Univ. of Sydney). p.73-5 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

Pure strain CBA, C57, and DBA mice and Wistar rats, at least eight generations inbred, were used. Following irradiation, the mice received bone marrow cells, foetal spleen cells, and foetal liver cells from DBA mice and Wistar rats. The results are represented graphically and show the length of time of survival following irradiation and grafting. Although a capacity for enhanced survival using foetal donor material in heterografting is shown, the occurrence of secondary radiation disease in those surviving longer than six weeks is not prevented. (B.O.G.)

24001

AN EXPERIMENTAL STUDY OF THE INFLUENCE OF OXYGEN ON THE RADIO-SENSITIVITY OF THE EHRLICH ASCITES TUMOUR CELL. L. H. Gray (Mount Vernon Hospital, Northwood, Eng.). p.76-86 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

Experiments were conducted to compare the radiosensitivity of mammalian tumor cells in vivo and in vitro under controlled conditions of oxygen tension. The control and measurement of oxygen tension in an organized tissue seemed to present insuperable difficulties. It was considered that a better chance of success lay in an attempt to measure the concentration of dissolved oxygen in the peritoneal fluid at the time of irradiation in an animal bearing an Ehrlich ascites tumor. An inoculum of 10^7 cells gives rise in the course of 5 days to about 2 ml of fluid containing $\sim 10^8$ cells/ml. This fluid, diluted with plasma from the peritoneal fluid of other tumor-bearing animals with blood added to a mean concentration of 5×10^8 red blood cells/ml, was the fluid used for the in vitro irradiations. A careful preliminary investigation established that, provided the dose was adjusted to give roughly equal amounts of damage, the presence or absence of oxygen at the time of irradiation had no influence on the percentage of abnormal anaphases seen at different times after irradiation. When the inoculum was 0.2 ml containing $\sim 2 \times 10^7$ cells, the percentage of abnormal anaphases rose with increasing interval between irradiation and fixation to a flat maximum at 14 to 15 hr and then decreased. As a result cells were fixed at 14 hr after inoculation. (B.O.G.)

24002

THE EFFECT OF BETA RADIATION ON PORPHYRIN COMPOUNDS IN AQUEOUS SOLUTIONS. R. Tirrell (Univ. of New South Wales, Kensington). p.95-102 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

It is generally agreed that the irradiation product of a porphyrin or haem is an intact cyclical tetrapyrrole. A precise knowledge of the change due to irradiation is lacking, and the work described deals with two aspects of this. The effect of β radiation on protoporphyrin when it is dissolved in plasma from a fowl's blood is described; the effect of dose rate, as well as the general effect of radiation, is considered. The changes in the molecular structure of protoporphyrin and ferriprotoporphyrin when they are irradiated in alkaline solution are described. The investigations are part of a program concerned with radiation effects on the synthesis of porphyrins by the erythrocytes of the domestic fowl. (B.O.G.)

24003

THE INFLUENCE OF OXYGEN ON THE RADIOSENSITIVITY OF CELLS AND TISSUES. L. H. Gray (Mount Vernon Hospital, Northwood, Eng.). p.152-68 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. *and* London, Butterworths Scientific Publications, 1959.

Many cells and tissues are damaged much more by exposure to ionizing radiation if they are situated in an aerobic environment at the time of irradiation than if they are deprived of oxygen. In the great majority of cells, it was found that sensitivity is positively correlated with the availability of oxygen at the time of irradiation. A tabulation is given for the sensitivity of cells and tissues to x radiation classified in relation to dependence on oxygen tension. (B.O.G.)

24004

RADIO-PROTECTIVE ACTION OF 5-HYDROXYTRYPTAMINE. H. A. S. van den Brenk (Radiobiological Research Unit, Cancer Inst. Board, Melbourne). p.169-78 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. *and* London, Butterworths Scientific Publications, 1959.

Many chemicals that protect animals against ionizing radiations are known, but their exact mode of action remains in doubt. By analogy with polymer experiments *in vitro*, the mechanism appears dependent on an indirect competition for oxidizing radicals, particularly HO_2 radicals, produced by irradiation in tissue fluids. The experimental results from 5-hydroxytryptamine (5-OHT) indicate that radio-protection is intimately related to specific receptor-metabolite reactions in competent cells. It is difficult to reconcile these findings with the hypothesis of radio-protective mechanisms. It seems from the studies in animals depleted of histamine, 5-OHT, and catechol amines that the "bound" endogenous entity in cells does not confer cellular radio-resistance. Its change to a "free" form *in vivo* is necessary although a decrease in sensitivity of specific vasoconstrictor receptors allows for substantial protection to persist. (B.O.G.)

24005

EFFECTS OF RESPIRED OXYGEN—RADIO-PROTECTIVE ACTION OF CERTAIN AMINES: (a). LETHALITY STUDIES. H. A. S. van den Brenk and Ruth Moore (Radiobiological Research Unit, Cancer Inst. Board, Melbourne). p.179-86 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. *and* London, Butterworths Scientific Publications, 1959.

Considerable experimental evidence is available associating chemical protection against ionizing radiations with alteration in oxygen tension. Particular attention was given to sulfur-containing agents that exist as reducing (–SH) and oxidizing (–SS–) entities. The effects of pretreatment with cyanide and pressurization with pure oxygen on the effects of certain radio protective agents *in vivo* in mice and rats were investigated and compared. Partial pressures of respired oxygen varying from 0.05 to 5.0 atm. were used, and its effects on the protective action of cysteamine, cystamine, 5-hydroxytryptamine, histamine, and adrenalin were investigated. The preliminary studies and lethality findings are described. (B.O.G.)

24006

EFFECTS OF RESPIRED OXYGEN—RADIO-PROTECTIVE ACTION OF CERTAIN AMINES: (b). RAT LYMPHOCYTES (*IN VIVO*). Ruth Moore and H. A. S. van den Brenk (Radiobiological Research Unit, Cancer Inst. Board, Melbourne). p.187-9 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. *and* London, Butterworths Scientific Publications, 1959.

Rat lymphocytes, *in vivo* and *in vitro*, were used as a radiobiological indicator for the study of quantitative effects in nondividing but radiosensitive cells. The ratio of degeneration to normal cells at a predetermined time after irradiation can be used as a measure of radiation damage. The results of cell counts show that for rat lymphocytes *in vivo* there is no significant difference between irradiation of the animal in pure oxygen at 4 atm. absolute pressure and irradiation in air at atmospheric pressure. Both cystamine and 5-hydroxytryptamine (5-OHT) in the doses used gave significant protection against radiation *in vivo* for both cases; oxygen at 4 atm. reduces the protective effect of 5-OHT compared with air. No such difference was obtained using cystamine. The "oxygen effect," even in the presence of 5-OHT protection is small. The results agree with the findings described for lethality of protected rats respiring oxygen at various partial pressures. (B.O.G.)

24007

THE LIFE-SPAN OF MUTAGENS PRODUCED IN CELLS BY IRRADIATION. W. D. Jackson (Univ. of Tasmania, Hobart). p.190-208 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. *and* London, Butterworths Scientific Publications, 1959.

Seeds of *Allium cepa* var. Br. Spanish of different ages were examined for chromosome breakage. The seeds were examined when fresh and re-examined after two and four years. This seed was used for comparison with fresh seeds in irradiation experiments using soft x rays. The seeds were irradiated in vials in various mixtures of nitrogen and oxygen at doses of 0.8 kr to 6.4 kr and a temperature of 18 ± 1°C. All material was examined by germinating at 23°C and fixing at the peak of the first mitotic division in the radicle. Ageing of the seed causes an approximately exponential increase in spontaneous breakage. The approximate equivalent dose of x rays which must be given to fresh seed to produce the same level of damage as that found in four-year-old seed was 2.5 kr. When fresh seeds were irradiated in nitrogen, following 14 days' storage in nitrogen, much less damage resulted. A 7.0 kr dose in nitrogen was estimated to produce the same damage as the 2.5 kr dose in air or the four years' storage in air. Thus, it appears likely that oxygen is involved in the ageing process. (B.O.G.)

24008

INJURY AND RECOVERY IN NEUTRON-IRRADIATED ANIMALS. Howard H. Vogel, Jr., Donn L. Jordan, and Samuel Lesher (Argonne National Lab., Ill.). p.221-35 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. *and* London, Butterworths Scientific Publications, 1959.

Mice dying after x- and γ-irradiation within the acute lethal-dose range usually show a high mortality peak near the end of the second week after exposure with a characteristic haematological syndrome. The intestinal syndrome, in neutron-irradiated mice, seems to reach a peak between three and a half and six days following exposure. The duodenum of mice exposed to a single dose (350 rad) of fission neutrons is severely damaged with complete destruction of the crypts and the subsequent extensive loss of the epithelial lining of the villi. Less than half such animals live beyond the six-day period. A comparison of duodenal damage and recovery rate suggests a relative biological effectiveness (RBE) >6 when comparing the effects of neutrons and γ rays. The comparative effects of a single, postirradiation intravenous injection of bone-marrow cells in mice irradiated with lethal doses of fission neutrons and γ rays are illustrated. A type of experiment is given which shows that there is definite recovery following exposure to fission neutrons when 30-day mortality of mice is used as a criterion. The data indicate that the amount of recovery is related to the time intervals between equally paired doses. (B.O.G.)

24009

IMMUNOLOGICAL STUDIES ON LETHALLY AND SUBLETHALLY IRRADIATED ANIMALS. G. J. V. Nossal and Lois Larkin (Walter and Eliza Hall Inst., Royal Melbourne Hospital, Melbourne). p.236-43 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. *and* London, Butterworths Scientific Publications, 1959.

After large doses of whole-body irradiation, an animal is immunologically neutral for some time and can act as a host for immunologically competent cells. The behavior of these transferred cells were studied in adult and one-week old rats. The results of the transfer of immune spleen cells to normal recipients, the transfer of immune spleen cells to sub-lethally irradiated recipients, and the transfer of normal spleen cells stimulated *in vitro* to adult and neonatal irradiated recipients are illustrated graphically. The full implications are not clear, but it appears that for the first step in the chain of events leading to antibody formation to take place, the cells must be placed in a suitable environment, such as is provided by an adult animal. The possibility of isolating a "clone" of antibody-producing cells in the immunologically neutral environment of the neonatal rat or the x-irradiated adult rat was investigated by inoculating the recipients intraperitoneally with stimulated spleen cells. The recipients were killed two weeks later, their spleens were removed, restimulated *in vitro*, and injected into other recipient animals. These experiments were not quite as conclusive as was hoped. It was not possible to isolate a population of cells with abnormally high antibody-producing potential which might represent a pure "clone." (B.O.G.)

24010

EFFECT OF X IRRADIATION ON THE MOUSE FOETUS. A. S. Fraser and R. J. Hall (Univ. of Sydney). p.248-52 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. *and* London, Butterworths Scientific Publications, 1959.

Irradiation during foetal development can produce permanent modifications of the structure of the resultant organism, which, because they mimic the effects of mutants, are sometimes called phenocopies. Russell identified the sensitive periods of developmental sequences in the mouse in experiments concerned with fairly macroscopic aspects of structure. These experiments were extended to include any effects on the coat and skin. Pregnant mice, dated by the vaginal plug method, were irradiated with 85 kv x rays at 43 r/min. The mice were scored as dead or alive, as showing external morphological abnormalities, and for the presence or absence of the three secondary groups of facial whiskers. The experiments were conducted to compare the sensitive periods of macroscopic characters with those which could be easily scored. The data indicate a marked threshold effect. (B.O.G.)

24011

THE SPECTRUM OF SENSITIVITY OF *DROSOPHILA* GERM CELL STAGES TO X IRRADIATION. Irwin I. Oster (Indiana Univ., Bloomington). p.253-67 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. *and* London, Butterworths Scientific Publications, 1959.

Various external and internal conditions are known to affect the sensitivity of chromosomes to ionizing and non-ionizing radiations. Although there is no *a priori* reason to believe that one or even similar mechanisms underlie the sensitivity of all cell stages and organisms to radiation, it seems reasonable to suppose that elucidation of the variation in the sensitivity of different cell stages of one cell type under a variety of conditions may help to shed light on the basis for the differences in radiosensitivity among different organisms. It was found that the fruit fly, *Drosophila melanogaster*, is most suited for such a determination of sensitivity, since not only can induced heritable variations be easily detected and analyzed, but techniques are available which ensure that one is treating and testing cells that represent homogeneous samples of distinct stages of mitosis or meiosis. The procedure is outlined which was used in the treatment of the male germ cells of the fruit fly. The results show that although the spermatid stages received less than one-half as much radiation as the spermatozoa in the female, they yielded one-half again as many translocations. Results of the x irradiations on cell stages in the male and female *Drosophila melanogaster* are tabulated. (B.O.G.)

24012

THE GENETIC BASIS OF X-RAY INDUCED SOMATIC DAMAGE. Irwin I. Oster (Indiana Univ., Bloomington). p.268-71 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

The exposure of individuals to radiation, besides resulting in damage to various organ systems, was found to lead to an acceleration of the so-called "natural" ageing processes. A breakthrough on this problem occurred when it was found that male larvae of Drosophila melanogaster are more susceptible to killing by x rays than females. Experiments were conducted using hybrid third instar larvae from crosses of two unrelated stocks. This avoided the use of individuals already homozygous for deleterious genes. The individuals were exposed to 1280 r (135 kv, 20 ma; 1 mm Al filtration; 160 r/min) when their outer surfaces were fairly dry. The males and females resembled each other genotypically and phenotypically but differed in chromosomal morphology. The scheme used to obtain ring- and rod-shaped chromosome-bearing individuals is shown. The majority of the irradiated individuals which reached adulthood showed extreme wing abnormalities, lack of many bristles, and marked weakness which was presumably due to damage to the musculature. Mortality, in those cases in which it occurred during the preimaginal stages, occurred most frequently among late pupae and very rarely during the late larval and early pupal instars. These results demonstrate that this x-ray induced life-span shortening has a genetic basis, and they complement data obtained previously concerning the susceptibility to x-ray induced somatic damage of male and female larvae having one and two X chromosomes, respectively. (B.O.G.)

24013

RADIOBIOLOGICAL MECHANISM AT THE CELLULAR LEVEL: LINES OF INVESTIGATION WHICH HAVE BEEN OPENED UP BY THE RECENT TECHNICAL DEVELOPMENTS. L. H. Gray (Mount Vernon Hospital, Northwood, Eng.). p.282-300 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

Although the study of the effects of x rays on living cells was begun more than 60 years ago, the mechanisms involved are still unknown. The formation of ions and excited molecules represents a gross local disturbance from the molecular standpoint. Hitherto, the cell has acted as its own indicator of changes caused by ionizing radiations. Since the initial disturbances are approximately randomly distributed over all cell functions and the material that serves the functions are undergoing continuing synthesis, it is to be expected that the great majority will escape detection. Presently known forms of radiobiological damage do not constitute a representative cross section of the "built-in" defects and still less of all defects sustained by the irradiated cell but are a highly selected group. Some of the better known forms of radiobiological damage are considered to make evident the basis of selection of the group. The forms are damage to the genome—submicroscopic and visible, carcinogenesis, and visual receptors. In these forms, detection of the primary radiation disturbance at the molecular level has rested either on the uniqueness of the molecules or on the existence within the cell of a mechanism which responds to a change in a very small proportion of a large array of identical molecules. (B.O.G.)

24014

RADIOISOTOPES AND THE GENETIC MECHANISM: ISOTOPIC TRANSMUTATION AND BIOCHEMICAL FUNCTION. David Pratt (Univ. of California, Berkeley). p.123-31 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Incorporated radiophosphorous, P^{32}, inactivates either bacterial viruses or Escherichia coli bacteria by means of radioactive disintegrations which take place in their DNA. Of all radioactive disintegrations in the genetic substance, approximately one tenth actually inactivate. Their recoil energy breaks the DNA molecule in which they occur. This P^{32} decay induced death can be used as an experimental tool to study gene function and reduplication. (auth)

24015

RADIOISOTOPES AND THE GENETIC MECHANISM: THE PROBLEM OF GENETIC EFFECTS OF LOW-LEVEL EXTERNAL RADIOACTIVITY. Earl L. Green (Roscoe B. Jackson Memorial Lab., Bar Harbor, Me.). p.146-59 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The effects of low levels of radioactivity on the genetic constitution of future human populations may be estimated by three methods. The synthetic approach indicates that the proportion of defective human births will increase as the mutation rate increases. It has not provided an estimate of the changes in generalized traits which measure fitness among those members of the population who would not be classified as defective. The analytical approach has not yet yielded results on which to base a policy decision about exposure of populations to radiation. Research on human populations now in progress should soon yield valuable information. The empirical approach may yield results more quickly than the analytical approach but it will require an extrapolation from experimental animal populations to man. These discouraging statements should not be interpreted to mean that the problem is hopeless. Complementary evidence from all three approaches will probably yield the only way to estimate the effects of low levels of radioactivity on the genetic composition of the human population. 43 references. (auth)

24016

RADIOISOTOPES AND THE GENETIC MECHANISM: MUTAGENIC ASPECTS. M. R. Zelle (U. S. Atomic Energy, Washington, D. C.). p.160-80 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Consideration of the mutagenic aspects of radioisotopes in the biosphere focuses attention on the question of the linearity of the mutation-dose relation to very low doses delivered at very low dose rates. The observation of a lower mutation rate in mouse spermatogonia and oocytes when exposed at low dose rates does not necessitate abandoning the linear concept since the dose-rate effect could be due to processes which repair or prevent mutations. Such repair processes apparently do not function fully or at all in cells exposed at higher dose rates. Continued study of postirradiation modifications of induced mutation rates and chromosome aberrations in microorganisms, higher plants, and other suitable species may ultimately elucidate the complex mechanisms interposed between the absorption of the energy and the final production of the mutation. Similarly, studies of the production of mutations by transmutation of radioisotopes incorporated into DNA or protein constituents of the chromosome may also help to elucidate the fundamental nature of the change that is ultimately recognized as mutation. 56 references. (auth)

24017

GENETIC CONTROL OF PHYSIOLOGICAL PROCESSES: THE GENETICS OF RADIATION TOXICITY IN ANIMALS. Douglas Grahn (Argonne National Lab., Ill.). p.181-200 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The analysis of chronic radiation lethality data from one hybrid and five inbred mouse strains has suggested the hypothesis that all genotypes in a species will respond to radiation according to a single primary injury parameter. For single-dose exposure in the acute lethal range, the parameter is expressed as the number of days of life shortening per unit dose (28 days per 100 r). This term can be combined with others to provide equations that will predict either the life shortening or the survival time for any combination of normal life expectancy, leukemia incidence, ovarian tumor incidence, and dose. As a basic value, life shortening for both sexes exposed to 570 r is 111 days in the absence of leukemia and of ovarian dysfunction. With the same conditions, exposure to the LD$_{50/30}$ dose causes a constant proportion of life to be lost in all strains (19 per cent). Under continuous exposure the mean survival time and the mean accumulated dose vary directly with the control survival. Consequently, at any given daily dose rate, diverse strains that vary in their control survival lose the same proportion of their life expectancy. The mean accumulated dose under continuous exposure and the single LD$_{50/30}$ dose are related to each other by a common relationship to the normal expectancy. However, there are exceptions to this. The data have been discussed in terms of offering additional indirect evidence for support of the concept that chronic radiation injury is basically attributable to induced somatic genetic damage. In a broad sense the study of genetic variation in the response of mice to whole-body irradiation becomes a study of the genetics of viability. Genetic variation in normal life expectancy underlies the variation in response to radiation. Strain or genotype specific sensitivities to tumor induction are of a secondary physiological genetic nature, whose effects can be separated from the basic injury. Studies in this area can contribute much to the understanding of radiation damage. Radiobiological techniques appear to offer unique value in investigations of the genetics of life expectancy. 41 references. (auth)

24018

RADIOISOTOPES AND THEIR RELATION TO THE GENETIC MECHANISM AND PHYSIOLOGICAL PROCESSES: A CRITICAL REVIEW. R. K. Appleyard (Columbia Univ., New York). p.227-39 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Genetic considerations relevent to the presence of radioisotopes in the biosphere are reviewed. Some of the ways in which genetic constitutions of organisms may affect radioisotope burdens and their consequences are considered. Topics discussed include the genetic and species control of uptake and retention, genetic control of response, genetic hazards of irradiation of populations, radiation-induced and natural mutations, the mechanism of radiation induced mutations, transmutation experiments carried out with P^{32} and bacteriophage, the role of calcium as a necessary nuclear component, and the hazards from the transmutation and ionization produced by levels of C^{14} in the biosphere. 63 references. (C.H.)

24019

RADIOISOTOPES IN THE SKELETON: CONSIDERATIONS OF RADIATION DOSAGE IN RELATION TO BONE DAMAGE. L. F. Lamerton (Inst. of Cancer Research, Royal Cancer Hospital, London). p.382-400 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

The importance of biological variables, species, strain, and age of experimental animals on response to the biological effects of bone-seeking radioisotopes is discussed. The problem of bone damage is complicated by the nonuniform distribution pattern of radioisotopes in bone and the fact that the radiation response of bone must be considered as the result of responses of a number of different tissues, each having different susceptibilities to initial injury, repair, and recovery. Results are summarized from a number of studies on bone tumor incidence following the administration of P^{32}, Sr^{90}, Ca^{45}, Ra, or Pu. It is shown that the pattern of administration of the isotope affects the incidence of bone tumors and that the yield of tumors for the same total dose is greater when the isotope is administered in several injections at intervals varying from several days to a month. Problems are reviewed which are involved in attempts to calculate the pattern of radiation dose in bone. The relation between radiation dose, histological damage, and tumor production is discussed. It is concluded that at radiation dose levels capable of producing some degree of gross histological damage to bone, the incidence of bone tumors will be considerably affected by the type and severity of preexisting damage. 27 references. (C.H.)

24020

RADIOISOTOPES IN THE SKELETON: DOSAGE IMPLICATIONS BASED ON MICROSCOPIC DISTRIBUTION. Rolf Björnerstedt (Research Inst. of National Defense, Stockholm) and Arne Engström. p.401-22 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

An attempt is made to evaluate the biological effects of radiation from internally-deposited radioisotopes in bone. The general aspects of the problem are discussed on the basis of the behavior of Sr^{90}. The evaluation starts with the radioisotope distribution, which is measured for various intake conditions with autoradiographic techniques. The dose-rate distribution is then calculated from the radioisotope distribution. Pertinent data on Sr metabolism are employed to integrate the dose rate over time to yield the dose distribution under various conditions. The dose distribution may be correlated with either linear or threshold dose-response relations. The nature of bone salt and the microscopic distribution of bone salt are discussed. Findings are discussed and data are compared with the maximum permissible body burden of Sr^{90} that is recommended by the International Committee on Radiological Protection. 18 references. (C.H.)

24021

International Atomic Energy Agency, Vienna.
RADIATION DAMAGE IN BONE. Report and Summarized Papers of a Conference on the Relation of Radiation Damage to Radiation Dose in Bone held at Oxford, 10-14 April 1960. 1960. 56p.

A conference was held in April 1960 at Oxford, England, on the relation of radiation damage to radiation dose in bone. Summaries are presented of papers presented at this conference. Topics discussed include radiation dosimetry in bone; histologic damage from radiation in bone; the histogenesis of bone tumors; the relation between histological damage and subsequent development of bone tumors; the relation between the pattern of radiation dose in space and time, histological bone damage, and bone tumor production; the effects of accumulated radiation dose to the site; studies on the bones of radium workers and patients; and the relevance of subjects discussed to the problem of maximum permissible exposure. (C.H.)

Radiation Sickness

24022 JPRS-5239

STUDIES ON IRRADIATION SICKNESS IN THE USSR. A. K. Gus'kova and N. A. Kurshakov. Translated from Klin. Med. (U.S.S.R.) 38, No. 5, 20-6; 34-6(1960). 22p. OTS.

A review of radiation sickness studies in the USSR is presented. Part one covers the dynamics of the pathological process in the nervous system of individuals subjected to the protracted influence of comparatively small irradiation doses. Part two discusses errors in the diagnosis of chronic irradiation sickness. (47 references). (T.R.H.)

24023 JPRS-5316

ON THE MORPHOLOGICAL CHARACTERISTICS OF THE TAKEABILITY OF FREE SKIN TRANSPLANTS IN ACUTE RADIATION SICKNESS. K. K. Zaitseva (Zaytseva). Translated from Vestnik Khirurg. im. Grekova 84, No. 3, 97-102(1960). 12p. OTS.

Research was done on the morphological characteristics of the takeability of free autogenous skin grafts during acute radiation sickness. Piglets were irradiated to 250 to 400 r, 14 being burned on 2.3 to 4.8% of their body surface and 15 burned on 7 to 14%. All were infected with S. aureus and Streptococcus. On the fourth day surgical removal of burns and covering of wounds with perforated skin flap was performed. The animals were sacrificed and examined 4 to 55 days after the combined injury. In a second experimental group, 6 piglets with secondary radiation sickness were grafted and sacrificed 28 to 45 days later. It was found that the morphology of the takeability in the test animals qualitatively approached that of unirradiated animals. At the height of development of radiation sickness a partial necrosis of the autograft, death of the regenerated epithelium, and necrosis of the granulations of the donor areas were observed. Other observations are made concerning the results. (T.R.H.)

24024 JPRS-5371

ON THE DEVELOPMENT OF RADIATION SHOCK DURING ACUTE RADIATION TRAUMA (AN EXPERIMENTAL STUDY). (O Razvitii Luchevogo Shoka Pri Ostroy Luchevoy Travme (Eksperimental'nye Issledovaniya)). I. N. Kruk. Translated from Novyi Khirurg. Arkh. Ukr. S.S.R. No. 2, 96-101(1960). 10p. OTS.

A study was made in rabbits of the dynamics of blood hemoglobin, erythrocyte and leucocyte count in peripheral blood, ratio of liquid to solid, arterial pressure, respiration, flow rate, mass of circulation, and pathomorphological changes for doses of 1000, 1500, and 2000 r. Marked early hemodynamic impairment was observed, with reduction of hemoglobin, erythrocytes and leucocytes, liquefaction of the blood, reduction of pressure, flow rate, mass, spasm of peripheral vessels, dilatation and repletion with blood of vessels and organs of abdominal cavity, and dystrophic and necrobiotic processes. Also there are pronounced disturbances of respiration. The hemodynamic and respiratory disturbances develop quickly and reach a maximum at 3 to 5 hr with gradual restitution to initial levels in 24 hr. (T.R.H.)

24025

THE INFLUENCE OF IONIZING RADIATION UPON ANTIBODY FORMATION AND UPON THE UNSPECIFIC GAMMA-GLOBULINS OF THE BLOOD. L. G. Prokopenko (Kursk Medical Inst., USSR). J. Microbiol., Epidemiol. Immunobiol. (U.S.S.R.) (English Translation) 30, No. 9, 149-50 (1959).

A comparison of the pattern of antibody synthesis and of unspecific blood gamma globulins during radiation sickness in rabbits led to the conclusion that irradiation of animals with sublethal doses of x radiation causes disturbances of agglutinin and precipitin production. The production of precipitin was affected to a greater degree than agglutinin production. Irradiation with a lethal dose caused a marked suppression of precipitin production, whereas it activated the production of agglutinin. Simultaneously, the production of unspecific gamma globulin showed a decrease in animals exposed to radiation. (C.H.)

24026

THE MECHANISM OF THE DEVELOPMENT OF ENDOGENEOUS INFECTION IN ACUTE RADIATION. N. N. Klemparskaya (Klempar'skaia). J. Microbiol., Epidemiol. Immunobiol. (U.S.S.R.) (English Translation) 30, No. 11, 81-7(1959).

Following administration by mouth of 1000 million Salm. typhosa without any additional treatment in mice exposed to radiation, the organisms penetrated into the spleen, kidneys, and mesenteric lymph nodes after 1 hr and were excreted in the urine. Bacilli were detected more frequently in the kidneys and mesenteric lymph nodes and were excreted in larger numbers. There was a more intensive multiplication of the bacilli in the internal organs, and excretion of them in the urine was prolonged. (auth)

24027

THE POSSIBILITY OF THE PROLONGED CARRIAGE OF RICKETSIA PROWAZEKI. II. THE EFFECT OF PENETRATING RADIATION ON THE ISOLATION OF RICKETTSIA PROWAZEKI FROM ANIMALS WITH EXPERIMENTAL TYPHUS. M. K. Yatsimirskaya-Krontovskaya (Iatsimirskaia-Krontovskaia), T. V. Bocharova, and M. Sosnovskaya (Sosnovskaia) (Gamaleĭ Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, USSR). J. Microbiol., Epidemiol. Immunobiol. (U.S.S.R.) (English Translation) 30, No. 11, 93-6(1959).

In investigations carried out on a number of experimental animals previously infected with typhus, it was shown that under the influence of radiation sickness of varying severity Ricketsia prowazeki could not be isolated from the blood or organs. (auth)

24028

CHANGES IN THE BLOOD WITH CHRONIC RADIATION SICKNESS (EXPERIMENTAL DATA). M. S. Lapteva-Popova. Med. Radiol. 3, No. 2, 53-61(1958). (Translated from Referat. Zhur. Biol. No. 3, 1959, abstract No. 13389)

Dogs were subjected daily to total x irradiations of 5 to 10 r. Analysis of the peripheral blood was performed daily. The functional capacity of the bone marrow was determined by an injection of campolon/aqueous liver extract. In dogs with isolated stomachs the hematopoietic activity of the gastric juice was studied. The weight and body temperature were recorded, and the spinal reflexes were studied. The observations were continued for more than 5 years. X irradiations of 5 and 10 r evoked chronic radiation sickness. The reaction of the organism proceeded irregularly; periods of progression of the illness alternated with temporary compensation of the process. In the first period there was a lability in erythropoietic formation, in the second there was depression, in the third there was adaptation, and the fourth period was terminal. The sequence of periods depended on the daily dose of radiation, individual peculiarities, and resistance of the dogs to ionizing radiation. In the terminal period aplasia of the blood-forming organs, leukosis, and hyperchromic-macrocytic anemias were observed.

24029

ERRORS IN THE DIAGNOSIS OF CHRONIC RADIATION SICKNESS. M. N. Pobedinskiĭ and L. R. Protas (Central Research Inst. of Medical Radiology, Ministry of Health, USSR). Med. Radiol. 5, No. 7, 3-9(1960) July. (In Russian)

Data relative to errors in the diagnosis of chronic radiation sickness are presented. (auth)

24030

RADIOPROTECTIVE EFFECTS OF CYSTEAMINE ON PERIPHERAL BLOOD PICTURE OF ALBINO RATS. U. Nuvolone (Università, Messina, Italy). Radiobiol. Latina 2, 281-93(1959) Oct.-Dec. (In Italian)

The changes in the peripheral blood of albino rats pan-irradiated with 600 r and protected with cysteamine (β-mercaptoethylamine) in different doses administered in different ways were studied. Cysteamine protects against the blood changes only if given in the right dose (3 mg) intraperitoneally, immediately before irradiation. If administered 6 hr before irradiation it has no immediate protective action, but it enhances the recovery of hematopoiesis by protecting the recovery factor. Pretreatment during the days preceding irradiation appears to be useless and becomes harmful if continued after irradiation. Cysteamine injected into normal animals in total doses exceeding 48 mg (two 3 mg doses pro die 150 mg/kilo) causes leucopenia characterized by relative granulocytosis and lymphopenia. Cysteamine is thus shown to have a radiomimetic action on blood cells. (auth)

CHEMISTRY

General and Miscellaneous

24031 59USB5931-4(Pt.I)

United States Borax Research Corp., Anaheim, Calif. RESEARCH ON INORGANIC POLYMER SYSTEMS. Quarterly Report [for] April 1—June 30, 1959. July 15, 1959. 113p. Project No. 8-(8-7340). Contract AF33(616)-5931.

Investigations are reported on the chemistry of thermally stable inorganic and semi-inorganic polymer systems showing promise of utility at 1000°F. The bonding systems under study are B-B, B-N, and Al-O and polymers based on coordination, on Π-bonding, on polyvalent metals salts and on Sn are under investigation. In the B-B system, several new monomeric and prototypic compounds were prepared. Polymers were obtained by both ammonolysis and thermal-elimination reactions of tetra(alkylamino)-diborons. The thermal degradation of tetraalkoxydiborons is under investigation. In the B-N system, thermally and chemically stable thermoplastic resins were obtained from organoborazoles at elevated temperatures. Thermal-degradation experiments with arylborazoles indicate hydrocarbon formation to be the major reaction. In the Al-O system, several new substances containing Al-O bonds were synthesized. Pyridine suppresses O-Si cleavage which is otherwise facile in the presence of Al-O bonds. The thermal decomposition of some of these compounds was studied. Polymers were obtained by heterofunctional condensation. Thermal disproportionation was observed in some polymers at temperatures below those of thermal degradation. (For preceding period see 59USB5931-3(Pt.1).) (auth)

24032 AERE-M/R-2476

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE STRUCTURE OF CHROMIUM POTASSIUM ALUM. G. E. Bacon and W. E. Gardner. Feb. 1958. 22p.

A single-crystal study of chromium potassium alum was made by neutron diffraction. Hydrogen bonds link the oxygen atoms within the water molecules to other oxygen atoms in the structure. In each case the angle HOH for a water molecule is ~106°, although this sometimes entails appreciable displacement of the hydrogen atoms from the direct O-O line. Large thermal vibrations of the oxygen atoms in the sulfate groups were determined. (auth)

24033 AFOSR-TN-60-298

Hull, England. Univ.
THE INHIBITION OF THE HYDROGEN—OXYGEN REACTION BY METHANE. R. R. Baldwin, D. Booth, N. S. Corney, and R. W. Walker. [1960]. 29p. Contract AF61(052)-62.

The effect of CH_4 on the second limit of the $H_2 + O_2$ reaction was studied as a function of mixing time, vessel diameter, H_2 and O_2 mole fractions, temperature, and surface vessel. The results, determined in a KCl-coated vessel at 540°C, indicated that addition of up to 5 mole % CH_4 produced little effect on the second limit, but upon increasing the mole fraction of CH_4, a point was reached at which explosion is suddenly and completely suppressed. Possible mechanisms of the CH_4 inhibition are discussed. (C.J.G.)

24034 NP-8983

Celanese Chemical Co., Clarkwood, Tex.
THE SYNTHESIS AND EVALUATION OF AROMATIC ESTERS AS POTENTIAL BASE STOCK FLUIDS FOR GAS TURBINE ENGINE LUBRICANTS. Quarterly Progress Report No. 3 for May 1, 1960 to July 31, 1960. 50p. Project No. 3044. Contract AF33(616)-6786.

The program comprises the synthesis and evaluation of esters based on either aromatic polycarboxylic acids or aromatic polyols. Esters based on trimesic acid (1,3,5-benzene tricarboxylic), terephthalic acid (1,4-benzene dicarboxylic), and diphenic acid (2,2′-biphenyl dicarboxylic) were synthesized and esterified with phenols of the benzyl type and 2,2-dimethyl substituted alcohols. A few derivatives were prepared from trimethylolanisole (1-methoxy-2,4,6-trimethylolbenzene). These esters were evaluated for thermal stability in the 600 to 750°F temperature range. It was found that all esters containing a benzyl alcohol type structure are thermally unstable in the 600 to 700°F range, including the trimethylolanisole esters. Esters based on 2,2-dimethyl substituted alcohols exhibited a variable range of stabilities, depending on the acid used. It appeared that diphenic acid esters were considerably more stable than the corresponding trimesates or terephthalates. Esters of phenol appeared to be more stable than those of alkylated phenols and phenolic diphenates more stable than trimesates or terephthalates, which may be due, in part, to the greater ease of purification of the former. (auth)

24035 TID-6441
Pennsylvania State Univ., University Park and Michigan. Univ., Ann Arbor.
EFFECT OF STRUCTURE ON THE STEREOCHEMISTRY OF ELECTRODE REACTIONS. MONOBROMO C_4-DIBASIC ACIDS AND ESTERS. Report No. 60. Philip J. Elving, Isadore Rosenthal, John R. Hayes, and Aaron J. Martin. Aug. 8, 1960. 25p. Project No. 8. Contracts AT(30-1)-822 and AT(11-1)-70. OTS.

Monobromomaleic acid (MBMA), monobromofumaric acid (MBFA), and their diethyl esters were polarographically and coulometrically reduced over a pH range; the reduction products were identified polarographically and, in the case of macroscale electrolyses, by isolation and physical and chemical examination. The diethyl esters are reduced quantitatively in a two-electron process to the diethyl ester of fumaric acid. MBFA undergoes a two-electron reduction to fumaric acid. MBMA, however, is reduced to three products: maleic acid, fumaric acid, and a dimer, 1,2,3,4-butadienetetracarboxylic acid; the relative amounts of products formed are dependent on pH. The ratio of maleic acid to fumaric acid is the same at any pH as that found when α,α^1-dibromosuccinic acid is reduced. Reduction mechanisms are proposed to explain the products observed. Originally, one electron enters the molecule to release the halogen as an ion and to form a free radical. The latter can dimerize or can add another electron and a proton to form the unsaturated acid. The cis acid is formed if the species is in the singly ionized condition where a hydrogen bond between carboxyl groups stabilizes the cis configuration; otherwise, the trans acid is formed. Dimerization occurs only with MBMA probably because of an interaction known to exist between mercury and the cis acids. Such an interaction might stabilize the free radical so that enough can accumulate to enhance a second-order dimerization. (auth)

24036 WADD-TR-59-272(Pt.II)
Florida. Univ., Gainesville.
SYNTHESIS OF SEMI-INORGANIC FLUORINE POLYMERS. Period covered: June 1, 1959 through May 31, 1960. Henry C. Brown. June 1960. 69p. Project No. 7023. Contract AF33(616)-5616.

The mechanism of the deammonation reaction of perfluoroalkyl amidines was explored and the first step shown to be the formation of perfluoroalkyl imidines. These intermediate compounds readily form copper(II) and zinc chelates. Further steps in the deammonation reaction, which results finally in formation of a symmetrical triazine ring, are proposed. The possible formation of a linear polymeric structure from the low-temperature reaction of perfluoroglutaronitrile with perfluorobutyramidine is described. This structure is a possible precursor to a linear perfluoroalkyl-triazine polymer. Copolymerization of perfluoroglutaronitrile with perfluorobutyronitrile in the presence of basic catalysts other than ammonia is described. Copolymerization of perfluoroglutaronitrile with perfluoropropionitrile and perfluoroacetonitrile in the presence of catalytic amounts of ammonia appears to furnish copolymers of physical characteristics different from those previously reported but with high-temperature stability. Cotrimerization of perfluoroacetonitrile with benzonitrile is demonstrated and the resulting compounds, 2,4-bis phenyl-6-trifluoromethyl-1,3,5-triazine and 2-phenyl-4,6-bis trifluoromethyl-1,3,5-triazine, are considered as possible monomers. (For preceding period see WADD-TR-59-272 (Pt.I).) (auth)

24037 CEA-tr-R-921
APPLICATION DE L'ÉCHANGE D'IONS À L'ÉTUDE DE L'ÉTAT D'UNE SUBSTANCE EN SOLUTION. IV. ETUDE DE LA FORMATION DE COMPLEXES D'YTTRIUM AVEC L'ACIDE LACTIQUE PAR LA MÉTHODE DES "COURBES D'ABSORPTION." (Application of Ion Exchange to the Study of the State of a Substance in Solution. IV. The Investigation of the Complex-Formation of Yttrium with Lactic Acid by Means of the Method of "Absorption-Curves"). V. I. Paramonova, A. N. Mosevich (Mossevich), and A. I. Subbotina. Translated into French from Zhur. Neorg. Khim. 3, 88-94(1958). 18p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13808.

24038 SCL-T-331
THEORY OF THE PROPAGATION LIMIT OF QUIET FLAMES. (Teoria Predela Rasprostranenia Tikhogo Plameni). Y. B. Zeldovich. Translation of Excerpts by Marcel L. Weinreich (Sandia Corp.) from Zhur. Ekspt'. i Teoret. Fiz. 11, 159-69(1941). 16p. JCL or LC.

Investigations of the phenomena of combustion and explosion are described. It is noted that the characteristic of the velocity constant of chemical reactions is its strong Arrhenius dependence on the temperature with a great activation heat, connected with the marked thermal effect of combustion reactions. (J.R.D.)

24039

DETERMINATION OF THE DISSOCIATION CONSTANTS OF COMPLEX COMPOUNDS OF ASCORBIC ACID AND THE TiO^{+2} AND UO_2^{+2} IONS. Zofia Gregorczyk. Acta Polon. Pharm. 15, 333-42(1958). (Translated from Referat Zhur. Khim. No. 19, 1959, abstract No. 67494).

Optical methods were used in establishing that the dissociation constants of complexes of ascorbic acid with the TiO^{+2} ion are 9.58×10^{-4} and 5.5×10^{-3}, and with the UO_2^{+2} ion 1.30×10^{-3}. The molecular extinction coefficient at λ 465 mμ for the complex of ascorbic acid and TiO^{+2} ions is 1.34×10^{-3}; with UO_2^{+2} ions, it is 3.92×10^{-2}.

24040

THORIUM-EDTA COMPLEXES—A CONDUCTOMETRIC STUDY. A. T. Athavale, S. C. Saraiya, and A. K. Sundaram (Atomic Energy Establishment, Trombay, India). Anal. Chim. Acta 23, 200-1(1960) Aug. (In English)

Conductivity measurements were made on thorium-EDTA complexes. This conductometric study confirmed the formation of 1:1 and 1:2 complexes between thorium and EDTA. (M.C.G.)

24041

XXXI INTERNATIONAL CONGRESS OF INDUSTRIAL CHEMISTRY. VOLUMES I AND II, SEPTEMBER 7-20, 1958. LIÈGE, BELGIUM. 899p. (Vol. I), 877p. (Vol. II). Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958.

Papers are presented in Volume I on general technical problems of the chemical industry, fuels, nuclear science, metallurgy, and mineral chemical industry. Abstracts were prepared for 19 selected papers. (T.R.H.)

24042

INHIBITORY EFFECTS OF TRACES OF WATER VAPOR AND HYDROGENEOUS BODIES ON COMBUSTION OF GRAPHITE. G. Hoynant (Sté des Electrodes et Réfractaires "Savoie," France), F. Collart, X. Duval, and M. Tetort. Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 474-7. (In French)

Quantitative study of the effects of traces of water vapor on the combustion rate of graphite shows that this rate is, as an example, divided by 1.7 when there is at most one molecule of water fixed per 500 atoms of surface carbon. Evaluation of the number of reactive surface atoms, on the one hand according to the structure of these artificial graphites and on the other hand according to desorption experiments after combustion, shows that each molecule of water extends its effect to several reactive surface carbon atoms, creating around it a diffuse region of inhibition. (tr-auth)

24043

DEVELOPMENT OF THE NUCLEAR CHEMICAL INDUSTRY IN FRANCE. M. H. Fould (Commissariat à l'Énergie Atomique, [Paris]). Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 652-62. (In French)

With the impetus of the CEA, Electricitè de France, and Marine Marchande, the French nuclear effort reached 600 billion francs for the years 1957–61. More than half of this sum was spent by the chemical industry on research, pilot installations, and construction of plants. The greatest effort was exerted toward treatment of ores of the French Union to obtain pure uranium, preparation of fuel elements, re-treatment of used fuel elements, industrial fabrication of reactor and fuel materials, isotope development, and radioactive waste processing. (T.R.H.)

24044

LUBRICANTS FOR NUCLEAR POWER PLANTS. J. J. Frewing (Shell Petroleum Co., Ltd., [London]). Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 663-9. (In English)

Types of nuclear power plants now commercially available and the mechanisms in them presenting special lubrication problems due to the presence of radiation are discussed. The behavior of a range of lubricants to neutrons, gamma rays, and fast electrons was investigated and it was found possible to correlate the effects produced by these types of radiations. In hydrocarbon oils atomic radiation produces cross-linkage that causes an increase in viscosity, the extent of which depends on the composition of the oil. The paraffinic oils are the most unstable and ultimately solidify. Aromatic compounds naturally occurring in refined mineral oils have a beneficial effect, but some aromatic additives examined had little effect. Several synthetic lubricants were subjected to atomic radiation, but they were found to be more unstable than many of the petroleum hydrocarbons. Typical conventional greases became fluid at relatively low radiation doses, indicating a breakdown in the soap gel structure. Special lubricants are being developed which offer considerable resistance to atomic radiation. (auth)

24045

ANALYTICAL CHEMISTRY INSTALLATION FOR RADIOACTIVE PRODUCTS. M. Douis, A. Guillon, H. Laurent, R. Sauvagnac (Centre d'Études Nucléaires, Saclay, France). Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 687-92. (In French)

A sealed, shielded enclosure is described which permits manipulation and analytical control of radioactive products. Some of the techniques that are adapted for remote operation are pipetting, weighing, centrifugation, drying, volumetry, pH measurement, potentiometry, colorimetry, and polarography. Other apparatus can be quickly installed. Protected by 5 cm of lead and well ventilated, it gives complete security in manipulation up to a level of 400 millicuries of long-lived fission products. (T.R.H.)

24046

ESTABLISHMENT BY THERMAL ANALYSIS AND X RAYS OF PHASE DIAGRAMS OF THE SYSTEMS $NaCl-ZrF_4$ AND $NaF-ZrF_4$. R. Winand. Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 744-7. (In French)

In research on structure of cathodic deposits obtained in the solid state during molten salt electrolysis, it is important to have information on the phase diagram of the electrolyte studied. A study was made of the particular case of zirconium metal electrodeposition from ZrF_4 dissolved in NaCl or NaF. Not having found data on the $NaCl-ZrF_4$ and $NaF-ZrF_4$ phase diagrams in the literature, it was decided to make a quick study of these systems by thermal analysis and then complete the information obtained in this manner by x-ray examination. The apparatus and method used are briefly described, with emphasis on important details. It was found that the $NaCl-ZrF_4$ diagram is simple in aspect, presenting a eutectic with a low melting point. The $NaF-ZrF_4$ diagram is more complex showing definite compounds and several eutectics. In this latter system there is one composition zone which extends to the relatively low melting point. In the two cases, the measurements on the ZrF_4-rich side were obstructed by an appreciable volatilization caused by the high vapor tension of the molten mixture. (tr-auth)

24047

TREATMENT OF COMPLEX Ta–Nb–Fe MATERIALS FOR VERY-PURE SALTS, OXIDES, AND METALS OF Ta AND Nb: RESULTS AT THE HOBOKEN PILOT PLANT. R. Tougarinoff, Van Goetsenhoven, and Ronneau (S. G. Métallurgique, Hoboken, Belg.). Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 838-42. (In French)

The different treatment steps comprising alkaline dissolution are examined, putting tantalum, niobium, and a group of impurities in solution, and successively extracting tantalum and niobium by hexone. The degree of purity and the yields obtained for tantalum and niobium are given, as well as the yields from the treatment of the depleted effluent for tungsten recovery. The production of pure salts and oxides starting with pure solutions of tantalum and niobium in hexone is described, with reagent consumptions being given. The preparation of tantalum and niobium in metallic powder form is briefly examined with some examples of igneous electrolysis and sodium burning. (tr-auth)

24048

STUDIES ON THE MECHANISM OF OLEFIN-ALCOHOL INTERCONVERSION. THE EFFECT OF ACIDITY ON THE O^{18} EXCHANGE AND DEHYDRATION RATES OF t-ALCOHOLS. Robert H. Boyd, Robert W. Taft, Jr., Alford P. Wolf, and David R. Christman (Pennsylvania State Univ., University Park and Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 82, 4729-36(1960) Sept. 5.

Evidence from the acidity and temperature dependence of the rates of O^{18} exchange and dehydration of t-alcohols was obtained; this evidence indicates that these two reactions proceed by common initial steps but involve different rate-determining steps. The results appear to eliminate a mechanism in which a "free" carbonium ion isomerizes to a π-complex in the rate-determining step of the alcohol-olefin interconversion. Present results are found to be consistent with mechanisms which involve (in the formation of olefin from alcohol) either a rate-determining reaction of a free carbonium ion with water or the isomerization of an encumbered carbonium ion intermediate, $R^+ \ldots OH_2$, to a π-complex. The encumbered carbonium ion classification is proposed for intermediates which possess substantial carbonium ion character and involve measurable interactions between the cationic center and leaving or entering groups of either neutral or various charge types. The mechanism involving the encumbered carbonium ion intermediate is favored. (auth)

24049

INFLUENCE OF FLUORINE SUBSTITUTION ON THE PROPERTIES OF METAL CHELATE COMPOUNDS. III. URANYL(VI) CHELATE COMPOUNDS. R. Linn Belford, A. E. Martell, and M. Calvin (Univ. of Illinois, Urbana). J. Inorg. & Nuclear Chem. 14, 169-78(1960) Aug. (In English)

Ultraviolet, visible, and infrared absorption spectra of uranyl chelates of acetylacetone, trifluoroacetylacetone, and hexafluoroacetylacetone are described and interpreted on the basis of the electronic influences of the fluorine atoms. Infrared assignments are made in the carbonyl region. Factors involved in the preparation of uranyl chelates are discussed. (auth)

24050

THE PREPARATION OF STIBINE AND THE MEASUREMENT OF ITS VAPOUR PRESSURE. L. Berka, T. Briggs, M. Millard, and W. Jolly (Univ. of California, Berkeley). J. Inorg. & Nuclear Chem. 14, 190-4(1960) Aug. (In English)

By the addition of aqueous hydroborate to solutions of antimony trichloride, stibine was obtained in 25% yield (based on hydroborate). The vapor pressure of stibine was measured at 177 to 250°K, and the data were subjected to a thermodynamic analysis. (auth)

24051

ION EXCHANGE IN SOLVENT MIXTURES. I. ON THE DISTRIBUTION OF URANIUM BETWEEN ALCOHOLIC MINERAL ACID SOLUTIONS, AND THE STRONGLY BASIC ANIONEXCHANGER DOWEX-1. J. Korkisch, P. Antal, and F. Hecht (Universität, Vienna). J. Inorg. & Nuclear Chem. 14, 247-50(1960) Aug. (In German)

Data are given on the anionic behavior of uranyl ions in mixed solvents. The distribution coefficients for uranium on the strongly basic anion exchanger Dowex 1 were determined in hydrochloric-, nitric-, and sulfuric-acid solutions containing varying amounts of ethyl alcohol. (auth)

24052

ION EXCHANGE IN SOLVENT MIXTURES. II. ON THE DISTRIBUTION OF THORIUM, ZIRCONIUM, AND TITANIUM BETWEEN ALCOHOLIC MINERAL ACID SOLUTIONS AND THE STRONGLY BASIC ANIONEXCHANGER DOWEX-1. P. Antal, J. Korkisch, and F. Hecht (Universität, Vienna). J. Inorg. & Nuclear Chem. 14, 251-4 (1960) Aug. (In German)

Data are given on the anionic behavior of the tetravalent thorium, zirconium, and titanium in mixed solvents. The distribution coefficients for these elements on the strongly basic anion exchanger Dowex-1 were determined in hydrochloric-, nitric- and sulfuric-acid solutions containing varying amounts of ethyl alcohol. (auth)

Analytical Procedures

24053 AERE-R-3244

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A FIELD METHOD FOR THE MEASUREMENT OF HELIUM IN NATURAL GASES. M. Wilkins and J. D. Wilson. Apr. 1960. 34p. BIS.

A simple gas chromatograph for the measurement of helium in natural gases is described. A 6-m charcoal column is used to separate the gases and CO_2 is used as the carrier gas. 0.1% of helium in mixtures of hydrogen, air, CH_4, CO, and CO_2 can be detected, provided that the hydrogen is first removed with palladium sponge. The limit of detection depends directly upon the purity of the CO_2. The design of a high-pressure fractionating still is given in addition to the design of a portable chromatograph. (auth)

24054 CNI-34

Italy. Comitato Nazionale per le Ricerche Nucleari. Centro di Studi Nucleari, Ispra.

ANALISI PER ATTIVAZIONE. (Activation Analysis). F. Girardi. June 1960. 28p.

The principles of activation analysis and methods of detection and measurement of radioactivity from the irradiated samples are outlined. Applications of activation analysis in different fields are described. (auth)

24055 DEG-Report-134

United Kingdom Atomic Energy Authority. Development and Engineering Group, Capenhurst, Ches., England.

THE APPLICATION OF X-RAY FLUORESCENCE METHODS TO THE IN-LINE DETERMINATION OF URANIUM AND PLUTONIUM CONCENTRATIONS. K. J. H. Mackay and R. P. Thorne. Apr. 26, 1960. 31p. BIS.

A brief review was made of methods available for the excitation and detection of fluorescent x radiation and of the factors involved in the design of a nondispersive system for determining uranium and plutonium concentrations in processing-plant solutions. Comparison was made between x-ray generators and radioisotopes as sources of fluorescent x radiation. The relative merits of crystal spectrometry and electronic discrimination for both methods of excitation were considered in detail. It was concluded that the technique of x-ray fluorescence using radioactive sources and electronic discrimination offered the most promise in detecting uranium and plutonium concentrations. (M.C.G.)

24056 HW-64299

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A DETAILED STUDY OF THE CARRIER CONCENTRATION METHOD OF SPECTROCHEMICAL ANALYSIS. J. L. Daniel. Mar. 11, 1960. 97p. Contract AT(45-1)-1350. OTS.

A mechanism for the carrier concentration process of spectrochemical analysis is proposed. The essential steps in the process include conversion of U_3O_8 to UO_2 and O_2, reaction between UO_2 and Ga_2O_3 forming a eutectic melt, and freeing associated impurity materials within a microzone surrounding each Ga_2O_3 particle. Further steps include migration of the eutectic melt zones toward the sample surface, volatilization of constituents from the sample surface, and excitation in the arc stream, both directly and by collisions of the second kind. A partial phase diagram for the system UO_2-Ga_2O_3 is suggested. Specific recommendations are made for further basic study of the carrier concentration process. (auth)

24057 AEC-tr-4222

THE DETERMINATION OF RADIOSTRONTIUM IN URINE. V. Zbořil, I. Šebestian, T. Trnovec, and K. Ďurček. Translated from Chem. zvesti 14, No. 2, 91-4(1960). 4p. JCL.

A method was developed for determining small amounts of radiostrontium in urine, water, and other materials. To 1.5-liter samples 20 mg Ba and 30 mg Sr are added as carriers, and then 15 ml of saturated Na_2CO_3 and 10 ml of concentrated NH_4OH are added. The precipitate is allowed to stand overnight, centrifuged, dissolved precisely in 65% HNO_3, and diluted to 4 ml. Add in 6 ml of fuming HNO_3 and precipitates Ba and Sr, which are redissolved in 4 ml of distilled H_2O. $Fe(OH)_3$ is precipitated in the solution and centrifuged. The pH is adjusted and $BaCrO_4$ precipitated, centrifuged, re-dissolved, alkalized, and $SrCO_3$ precipitated. This precipitate is then dried and weighed, and its activity measured. (T.R.H.)

24058 CEA-tr-A-557
DE L'ÉCHANGE D'IONS AVEC FOCALISATION. VII. MICROANALYSE QUANTITATIVE DES MÉTAUX LOURDS ET DES TERRES RARES. (Ion Exchange with Focusing. VII. Quantitative Microanalysis of Heavy Metals and Rare Earths). E[rnst] Schumacher and H[ans] J[akob] (M. J.) Streiff. Translated into French from Helv. Chim. Acta 41, 1771-83(1958). 25p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 1982.

24059 CEA-tr-R-838
UTILISATION DU RÉACTIF "ARSENASO" POUR DOSER LES ÉLÉMENTS. (Use of the Reagent "Arsenazo" for Determination of the Elements). A. F. Kuteinikov. Translated into French from Zavodskaya Lab. 24, 1050-2(1958). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 10929.

24060 CEA-tr-R-925
DOSAGE DES TERRES RARES DANS LES MINÉRAUX ET LES CONCENTRÉS, PAR LA MÉTHODE RADIOSPECTROSCOPIQUE DE FLUORESCENCE. (Determination of Rare Earths in Ores and Concentrates by the Fluorescence Radiospectroscopy). R. L. Barinskii (Barinsky). Translated into French by B. De Trezvinsky from Zavodskaya Lab. 24, 613-17(1958). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 4516.

24061 CEA-tr-X-191
MÉTHODES RAPIDES D'ANALYSE DES MÉTAUX ET DES MINÉRAUX. VII. DOSAGE POLAROGRAPHIQUE DU CÉRIUM DANS LES ALLIAGES ET LES MATIÈRES PREMIÈRES MINÉRALES. (Rapid Methods for Analysis of Metals and Ores. VII. Polarographic Determination of Cerium in Its Alloys and Primary Ore Materials). J. Dolezal and J. Novak. Translated into French from Chem. listy 52, 2060-5(1958). 17p.

This paper was previously abstracted from German, from Collection Czechoslov. Chem. Communs. 24, 2291-8 (1959) and appears in NSA, Vol. 13, as abstract No. 22013.

24062 NRL-Trans-788
France. Commissariat à l'Énergie Atomique, Paris. TITRATION OF SODIUM OXIDE IN SODIUM. THE MERCURY METHOD: ITS USE IN THE CASE OF VERY LOW VALUES. (Dosage de l'Oxyde de Sodium Dans le Sodium. La Méthode au Mercure: Son Utilisation Dans le Cas de Très Faibles Teneurs). L. Champeix, R. Darras, and J. Duflo. Translated by A. Pingell (Naval Research Lab.) from Report CEA-835, 1958. 16p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 17781.

24063 UCRL-Trans-548(L)
MEASUREMENT OF LOW α- AND β-ACTIVITIES IN WATER. A. Dannecker, H. Kiefer, and R. Maushart. Translated by Richard B. Mudge from Nukleonik 1, 319-24(1959). 28p. (Includes original, 6p.). JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 2419.

24064 UCRL-Trans-558(L)
A NEW GRAVIMETRIC METHOD FOR DETERMINING TIN: PRECIPITATION OF STANNIC SELENITE. Rodrigo Guedes de Carvalho. Translated for Univ. of California, Berkeley from Rev. quim. pura e apl. (4) 1, 24-41(1950). 13p. JCL.

A study was made of various methods for determining tin. A stannic selenite method was developed for the precipitation and determination of tin. (W.L.H.)

24065
SEPARATION OF NIOBIUM AND TANTALUM FROM ZIRCONIUM WITH SALICYLHYDROXAMIC ACID. A. K. Majumdar and A. K. Mukherjee (Jadavpur Univ., Calcutta). Anal. Chim. Acta 22, 25-6(1960) Jan. (In English)

Salicylhydroxamic acid can be used for the separation of zirconium from niobium above pH 2.5 in presence of hydrogen peroxide. Niobium can be precipitated from the filtrate with N-benzoyl-N-phenylhydroxylamine. (auth)

24066
THE QUANTITATIVE ANALYSIS OF MIXTURES OF CORROSIVE HALOGEN GASES BY GAS—LIQUID CHROMATOGRAPHY. J. F. Ellis, C. W. Forrest, and P. L. Allen (United Kingdom Atomic Energy Authority, Capenhurst, Ches., Eng.). Anal. Chim. Acta 22, 27-33(1960) Jan. (In English)

The feasibility of separating many volatile, corrosive halogen compounds by gas-liquid chromatography was demonstrated. The potentialities and limitations of the method when applied to analyses of mixtures containing uranium hexafluoride, chlorine, chlorine monofluoride, chlorine trifluoride, and hydrogen fluoride are detailed. The technique appears to be applicable for use generally in process-gas analysis and in the laboratory to research studies on inorganic reactions. (auth)

24067
SPOT TESTS FOR THE IDENTIFICATION OF TITANIUM ALLOYS AND THEIR DIFFERENTIATION FROM ZIRCONIUM AND ITS ALLOYS. H. C. J. Saint (Imperial Chemical Industries, Ltd., Birmingham, Eng.). Anal. Chim. Acta 22, 50-5(1960) Jan. (In English)

Simple spot tests are described for the rapid differentiation of a range of titanium alloys and for distinguishing these materials from zirconium and its alloys. After a preliminary attack of the abraded metal surface with either fluoboric or hydrofluoric acid, characteristic colored reaction products are formed with well-known reagents. These tests served to classify the material. (auth)

24068
SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF INDIUM IN URANIUM AND THORIUM METALS AND THEIR SALTS. V. T. Athavale, T. P. Ramachandran, M. M. Tillu, and G. M. Vaidya (Atomic Energy Establishment, Trombay, India). Anal. Chim. Acta 22, 56-60(1960) Jan. (In English)

A method based on dithizone extraction and determination of indium in the range of 0.1 to 10 ppm in reactor grade uranium and thorium samples is described. Sodium thiosulfate is used as a complexing agent for removing interference by lead and bismuth. (auth)

24069
REACTIONS OF PLUTONIUM IONS WITH ETHYLENEDI-

AMINE TETRAACETIC ACID. O. L. Kabanova, M. A. Danuschenkova, and P. N. Paley (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Anal. Chim. Acta 22, 66-75(1960) Jan. (In French)

The behavior of plutonium ions in a solution of trilon B (disodium salt of ethylenediaminetetraacetic acid) was investigated. At pH 3 to 5 plutonium(VI) is reduced to plutonium(V) and a (1:1) complex of plutonium(V) and trilon B is formed. With excess trilon B a plutonium(IV)—trilon B complex is formed after some time. (auth)

24070

AMPEROMETRIC TITRATION OF BORON WITH FRUCTOSE. W. B. Swann, Wallace M. McNabb, and J. F. Hazel (Univ. of Pennsylvania, Philadelphia). Anal. Chim. Acta 22, 76-81(1960) Jan. (In English)

Aqueous solutions of borate were titrated amperometrically with standard fructose solutions. This procedure can be used to determine the boron content of various types of samples after conversion to the borate. The method is based on the observation that the polarographic wave of fructose in a 0.1M LiCl, 0.01N LiOH solution is depressed by the presence of borate ions. Under the prescribed conditions the method is sensitive to a few hundredths of a mg of boron. The few commonly occurring interferences can be conveniently removed prior to titration. (auth)

24071

THE DETERMINATION OF URANIUM BY CATHODE-RAY POLAROGRAPHY. E. Booth and E. A. Terry (United Kingdom Atomic Energy Authority, Woolwich Outstation, Eng.). Anal. Chim. Acta 22, 82-7(1960) Jan. (In English)

The determination of uranium in the concentration range 2×10^{-6} to 4×10^{-3}M was studied by using both conventional and cathode-ray polarography. The preferred supporting electrolyte is 1M perchloric acid. Molybdenum is the only element which will cause serious interference at levels of the same order as that of the uranium. (auth)

24072

CHROMATOGRAPHIC SEPARATION OF SOME ALKALI METALS. E. C. Martin (New South Wales Univ. of Tech., Sydney). Anal. Chim. Acta 22, 142-4(1960) Feb. (In English)

The chromatography of the alkali metals, magnesium, calcium, strontium, barium, silver, and cadmium is described. Five per cent 15N NH_3 in methanol is used as a solvent, and bromophenol blue is used to identify the spots. Interfering elements were studied. The method gives a rapid and more positive method of separation and identification than was previously possible. (auth)

24073

THE SPECTROCHEMICAL DETERMINATION OF TOTAL STRONTIUM IN BONE, MILK AND VEGETATION. R. V. Jury, M. S. W. Webb, and R. J. Webb (Atomic Energy Research Establishment, Woolwich Outstation, Eng.). Anal. Chim. Acta 22, 145-52(1960) Feb. (In English)

Samples of bone ash were mixed with anhydrous copper sulfate and graphite and pelleted. A d-c arc was used to excite the spectra which were then evaluated by microphotometry. The effective concentration range was 50 to 350 ppm of strontium in the ash, and the coefficient of variation was 6% for single exposures at the 90 ppm level. In the case of milk and vegetation, strontium and calcium were separated as insoluble oxalates, and the strontium content of this fraction was determined by a method similar to that used for bones. This method had a similar range and accuracy. An alternative flame photometric method is described for the determination of strontium in the calcium-strontium oxalate fraction, the coefficient of variation of the whole analytical operation being 5% per determination. (auth)

24074

CATION-EXCHANGE BEHAVIOUR OF URANIUM(VI) ON AMBERLITE IR-120. SEPARATION FROM MIXTURES. Shripad M. Khopkar and Anil K. De (Jadavpur Univ., Calcutta). Anal. Chim. Acta 22, 153-8(1960) Feb. (In English)

Quantitative studies are reported on the cation-exchange behavior of uranium(VI) at the milligram level with Amberlite IR-120. Hydrochloric, nitric, sulfuric, perchloric, acetic, and citric acids were tested as eluants; 200 to 300 ml of 2 N hydrochloric, nitric, or sulfuric acid suffice for quantitative elution of 1.7 mg of uranium(VI) from a 1.4 cm × 14.5 cm bed. The efficiency of the eluting agents is discussed in terms of their elution constants. Uranium is separated from thorium by selective elution, from zirconium, cerium(III), copper, and nickel by converting the latter into suitable anionic complexes, and from phosphate just by passing the mixture through the cation exchanger. (auth)

24075

SPECTROPHOTOMETRIC DETERMINATION OF THE RARE EARTHS YTTRIUM AND CERIUM BY BROMOPYROGALLOL RED. J. Herrington and K. C. Steed (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Anal. Chim. Acta 22, 180-4(1960) Feb. (In English)

A method is described for the spectrophotometric determination of microgram quantities of rare earths, yttrium, and cerium(II) ions, with the use of the color of the complexes formed with bromopyrogallol red. The procedure was applied to pure solutions containing 10 to 50 μg of the element. (auth)

24076

ANALYSIS OF ALLOYS OF TITANIUM, NIOBIUM AND TANTALUM BY ION EXCHANGE. C. U. Wetlesen (Central Inst. for Industrial Research, Oslo). Anal. Chim. Acta 22, 189-91(1960) Feb. (In English)

A procedure for the analysis of alloys of titanium, niobium, and tantalum is described. After dissolution the metals are separated by ion exchange in hydrochloric-hydrofluoric acid media. Finally the metals are determined spectrophotometrically. (auth)

24077

COLOUR REACTIONS AND PAPER CHROMATOGRAPHIC STUDIES OF YTTRIUM AND ZIRCONIUM. G. Kallistratos, A. Pfau, and B. Ossowski (Max-Planck-Institute for Animal Breeding and Animal Nutrition, Mariensee/Trenthorst, Ger.). Anal. Chim. Acta 22, 195-9(1960) Feb. (In English)

The color reactions of yttrium and zirconium with some organic reagents were investigated and their sensitivity is reported. Some fluorescent reactions in ultraviolet light are also described, and solvent mixtures for the separation of the two elements by paper chromatography are given. (auth)

24078

POLARIMETRIC DETERMINATION OF ZIRCONIUM(IV) WITH TARTRAZINE. Gr. Popa, D. Negoiu, and Gh. Baiulescu (C. I. Prahon Univ., Bucharest). Anal. Chim. Acta 22, 200-2(1960) Feb. (In German)

A new polarimetric procedure was developed for the rapid determination of zirconium in the presence of tartrazine as a reagent. This determination is possible in the presence of uranium. (auth)

24079

DETERMINATION OF SUBMICROGRAM QUANTITIES OF

RUTHENIUM BY CATALYSIS OF THE CERIUM(IV)–ARSENIC(III) REACTION. Charlio Surasiti and E. B. Sandell (Univ. of Minnesota, Minneapolis). Anal. Chim. Acta 22, 261-9(1960) Mar. (In English)

Ruthenium in amounts of 0.005 to 0.1 μg can be determined by its catalysis of the slow reaction between cerium(IV) and arsenic(III) in sulfuric acid solution. The rate of the catalyzed reaction is obtained by measuring the concentration of cerium(IV) spectrophotometrically as a function of time. Ruthenium is first separated by Carbon tetrachloride extraction of the tetroxide, following argentic oxide oxidation. Osmium tetroxide is removed by prior extraction with Carbon tetrachloride after differential oxidation with nitric acid. Osmium can also be removed by boiling an acid solution with hydrogen peroxide. Ruthenium is left in solution. (auth)

24080

DETERMINATION OF NIOBIUM IN THE PRESENCE OF TANTALUM AFTER EXTRACTION WITH METHYL ISOBUTYL KETONE. Paschoal Senise and Lília Sant'Agostino (Universidade, São Paulo, Brazil). Anal. Chim. Acta 22, 296-7(1960) Mar. (In English)

Experiments for the determination of niobium in the presence of tantalum, after extraction from hydrochloric acid solutions with methyl isobutyl ketone, were run with solutions containing 10 μg Nb and either 10, 200, 500, or 1000 μg Ta. Results were in perfect agreement with those obtained with the same concentration of Nb in the absence of Ta. No interference was observed in any region of the spectrum of the colored solution that the extracted Nb formed with an alcohol solution of phenylfluorone. (M.C.G.)

24081

SEPARATION AND GRAVIMETRIC DETERMINATION OF NIOBIUM, TANTALUM AND TITANIUM BY PRECIPITATION WITH N-BENZOYL-N-PHENYLHYDROXYLAMINE. F. J. Langmyhr and T. Hongslo (Univ. of Oslo). Anal. Chim. Acta 22, 301-5(1960) Apr. (In English)

A method is described for the separation and gravimetric determination of niobium, tantalum, and titanium by precipitation with N-benzoyl-N-phenylhydroxylamine. Titanium is kept in solution with ethylenediaminetetraacetic acid (disodium salt) and hydrogen peroxide and the earth acids are precipitated in 1N sulfuric acid. Niobium and tantalum are separated and determined by a modification of the method of Majumdar and Mukherjee. All three metals are finally precipitated with N-benzoyl-N-phenylhydroxylamine. In the analysis of complex materials niobium, tantalum, and titanium are separated from other constituents by a double precipitation with N-benzoyl-N-phenylhydroxylamine in the presence of EDTA and tartaric acid. (auth)

24082

FLAME SPECTRA OF Sc, Y AND RARE-EARTH ELEMENTS. T. C. Rains, H. P. House, and Oscar Menis (Oak Ridge National Lab., Tenn.). Anal. Chim. Acta 22, 315-27(1960) Apr. (In English)

Flame spectra are presented of scandium, yttrium, and the rare-earth elements, except cerium and promethium. These elements were extracted with a solution of 2-thenoyltrifluoroacetone in 4-methyl-2-pentanone (hexone) and their spectra in the organic medium were subsequently recorded by means of a flame spectrophotometer. The precise wavelength and relative spectral intensity of each line and band are tabulated. Included also are the ½-band widths and the relative spectral interferences of other elements of the group with the emission of measurement of the bands and lines listed. Operating conditions, applicability, and limitations of the method in the estimation of some of the rare-earth elements are given. (auth)

24083

DETERMINATION OF PROTACTINIUM-233 IN IRRADIATED THORIUM. J. J. McCormack, F. H. Cripps, and W. A. Wiblin (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Anal. Chim. Acta 22, 408-13 (1960) May. (In English)

A method was devised for the absolute determination of Pa^{233} in irradiated thorium metal by counting the β emission of chemically separated and purified sources. The counter was calibrated by a source of Np^{237} of known activity in equilibrium with its Pa^{233} daughter, and checked by 4-π counting. (auth)

24084

SPECTROPHOTOMETRIC DETERMINATION OF BERYLLIUM IN AIR AND DUST. R. H. A. Crawley (English Electric Co., Ltd., Whetstone, Eng.). Anal. Chim. Acta 22, 413-20(1960) May. (In English)

The requirements of beryllium monitoring are discussed. Emphasis is placed on developing an analytical procedure which is rapid, simple to operate, of adequate sensitivity, and of reasonable accuracy. For air analysis, beryllium-bearing dust is collected on a membrane filter; the beryllium is obtained in solution and determined spectrophotometrically, using aurine tricarboxylic acid (aluminon) as reagent. Interference owing to other metals is avoided by the addition of suitable complexing agents. A sensitivity of 0.1 μg beryllium can be achieved. (auth)

24085

RAPID METHOD FOR THE DETERMINATION OF FLUORIDE IN LIQUIDS. S. A. Bartkiewicz and J. W. Robinson (Esso Standard Oil Co., Baton Rouge, La.). Anal. Chim. Acta 22, 427-31(1960) May. (In English)

A rapid procedure was developed for the determination of total fluoride in liquids. The samples are burned in a modified Beckman oxy-hydrogen burner. The fluoride is scrubbed out of the products of combustion and determined in any conventional manner. (auth)

24086

SEPARATIONS INVOLVING SULPHIDES. XII. SEPARATION OF THORIUM OR TITANIUM FROM SOME ELEMENTS THAT FORM THIOSALTS. I. K. Taimni and S. N. Tandon (Univ. of Allahabad, India). Anal. Chim. Acta 22, 437-8(1960) May. (In English)

Sodium sulfide can be used to separate arsenic, antimony, tellurium, selenium, molybdenum, mercury, gold, platinum, or rhenium from thorium. It can also be used to separate antimony, tellurium, selenium, or mercury from titanium. (auth)

24087

THE DETERMINATION OF TANTALUM AND TUNGSTEN IN ROCKS AND METEORITES BY NEUTRON ACTIVATION ANALYSIS. D. H. F. Atkins and A. A. Smales (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Anal. Chim. Acta 22, 462-78(1960) May. (In English)

A method for the determination of sub-microgram amounts of tantalum and tungsten in rocks and meteorites by neutron activation analysis is described. Radiochemical separation from the components of the irradiated sample was employed to provide sources for measuring Ta^{184} and W^{187} by β and γ counting and by γ spectrometry. Determinations of tantalum at the lower limit of 8×10^{-10} and tungsten at 2×10^{-9} g were made. Among the materials examined using the method were the intercomparison of rocks GI and

WI, rock samples from the Skaergaard Intrusion of East Greenland, and a number of iron and stony meteorites. In addition, a number of standard steel samples of known tungsten content and one of known tantalum content were examined and good agreement was observed between the published results and those determined by activation analysis. (auth)

24088

SPECTROPHOTOMETRIC DETERMINATION OF URANIUM WITH 1-(2-PYRIDYLAZO)-2-NAPHTHOL. Shozo Shibata (Government Industrial Research Inst., Nagoya, Japan). Anal. Chim. Acta 22, 479-84(1960) May. (In English)

1-(2-Pyridylazo)-2-naphthol reacts with uranium to form a deep red precipitate in ammoniacal solutions. This can be extracted with chloroform if sodium chloride or sulfate is added and it has a maximum absorption at 560 mμ. The color is stable and follows Beer's law. Trace amounts of uranium may be determined in the presence of many metals without prior separation if strong complexing agents, such as ethylenediaminetetraacetic acid (disodium salt) or cyanide, are added. (auth)

24089

DETERMINATION OF NIOBIUM AND TANTALUM WITH CINNAMYL HYDROXAMIC ACID AND N-CINNAMOYL-N-PHENYLHYDROXYLAMINE. A. K. Majumdar and A. K. Mukherjee (Jadavpur Univ., Calcutta). Anal. Chim. Acta 22, 514-19(1960) June. (In English)

The determination and separation (from other ions) of niobium and tantalum by means of cinnamylhydroxamic acid and N-cinnamoyl-N-phenylhydroxylamine are described. Cinnamylhydroxamic acid permits the separation of both elements above pH 5.0 (titanium, zirconium, and molybdenum interfere) and the niobium complex can be weighed after drying at 110°. With N-cinnamoyl-N-phenylhydroxylamine, the optimum conditions are slightly different; titanium, zirconium, vanadate, molybdate, tungstate, iron, tin, and antimony contaminate these precipitates. (auth)

24090

THE POLAROGRAPHIC DETERMINATION OF HEXAVALENT URANIUM IN THE PRESENCE OF EXCESS FERRIC IRON. A. A. Verbeek, J. T. Moelwyn-Hughes, and E. T. Verdier (Univ. of Natal, Pietermaritzburg, South Africa). Anal. Chim. Acta 22, 570-6(1960) June. (In English)

It is shown that concentrations of uranyl ions varying from 10^{-4} to 10^{-3}M may be rapidly determined polarographically, to an accuracy of 4% (95% confidence), in the presence of concentrations of ferric iron up to four hundred times in excess of the uranyl ion concentration. The determination is insensitive to the concentration of the 0.75M sodium fluoride used as a supporting electrolyte, and to time; but is not valid if the pH of the test solution is below 6.5. The ions Cu^{2+}, Pb^{2+}, and Mn^{2+} are shown not to interfere, while Ti^{3+} must be removed. (auth)

24091

THE DETERMINATION OF ^{235}U BY THE ISOTOPE DILUTION METHOD. R. K. Webster, D. F. Dance, J. W. Morgan, E. R. Preece, L. J. Slee, and A. A. Smales (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Anal. Chim. Acta 23, 101-15(1960) Aug. (In English)

An examination was made of the precision which might be achieved by using an isotopic dilution method for the determination of U^{235} in the feed solution of an enriched uranium fuel chemical processing plant such as the Dounreay M.T.R. chemical plant. Four solutions were prepared to simulate diluted samples of feed solution. They contained uranium with an isotopic content ranging from 93% U^{235} to 50% U^{235}. Separation of uranium was made by solvent extraction with tri(iso-octyl)amine, and isotopic analyses were then made using two Metropolitan-Vickers M.S.$_5$ mass spectrometers. Both U^{233} and natural uranium were examined as possible tracers. Using U^{233} as the tracer the results for the four solutions yield a mean precision (3 σ) of 0.37% for a result based on six replicate analyses and 0.83% for one based on a single analysis. These values include the random errors involved in the mass spectrometric calibration of the tracer, but not errors associated with the gravimetric preparation of a U^{235} standard or those which would be concerned with taking a sample from a plant. The results obtained using a natural uranium tracer are less satisfactory, and possible explanations are suggested. (auth)

24092

HEMATOXYLIN AS INDICATOR IN THE CHELATOMETRIC TITRATION OF METALS. Antonio Celso Spinola Costa (Univ. of Bahia, San Salvador). Anal. Chim. Acta 23, 127-30(1960) Aug. (In English)

Hematoxylin is suggested as an indicator in the titration of several metals with EDTA. Bismuth and zirconium were readily determined in acidic medium. Several other metals also gave color reactions, but the color changes on addition of EDTA were not sharp. (auth)

24093

ANALYTICAL CHEMISTRY OF ZIRCONIUM. I. o-CRESOTIC ACID AND 4-AMINOSALICYLIC ACID IN THE DETERMINATION OF ZIRCONIUM. V. V. Subbanna and A. K. Bhattacharya (Saugar Univ., Sagar, India). Anal. Chim. Acta 23, 145-6(1960) Aug. (In English)

o-Cresotic acid and 4-aminosalicylic acid were found to be suitable for quantitative precipitation of zirconium. The precipitate was ignited and weighed as ZrO_2. The optimum pH ranges were 1.4 to 5.4 and 1.4 to 3.3, respectively. (auth)

24094

THE DETERMINATION OF STRONTIUM IN ROCKS AND BIOLOGICAL MATERIALS. B. A. Loveridge, R. K. Webster, J. W. Morgan, A. M. Thomas, and A. A. Smales (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Anal. Chim. Acta 23, 154-71(1960) Aug. (In English)

Methods are described for the determination of strontium in a variety of materials by neutron activation and by stable isotope dilution. The samples for neutron activation analysis, together with strontium standards, are irradiated in a high-neutron flux for a few hours (Sr^{187m}, 2.7 hour half life) or for a week or more (Sr^{89}, 54 day half life). After dissolving in the presence of strontium carrier, samples and standards are subjected to radiochemical purification. The β activity induced in the samples and standards is compared and the quantity of strontium in the sample calculated by proportion. Somewhat less than one microgram of strontium can be determined. For stable isotope dilution analysis, the sample is mixed with a known quantity of Sr^{84} tracer and dissolved in a mixture of hydrofluoric and perchloric or nitric and perchloric acids. Strontium is then usually separated by cation-exchange chromatography, but for samples with large strontium concentrations, it is possible to obtain spectrometric analysis before making the mass results without a separation. The main source of systematic error is strontium contamination, but with simple precautions this may be restricted to 1 to 4% of the quantity of strontium determined and a correction applied. (auth)

24095

SEPARATION OF NIOBIUM, TANTALUM, TITANIUM AND ZIRCONIUM FROM EACH OTHER. A. K. Majumdar and A. K. Mukherjee (Jadavpur Univ., Calcutta). Anal. Chim. Acta 23, 246-7(1960) Sept. (In English)

A method for the separation and determination of titanium, zirconium, niobium, and tantalum is described. Niobium and tantalum are separated with pyrogallol from titanium and zirconium and determined by the N-benzoyl-N-phenyl hydroxylamine method. Pyrogallol is decomposed, and zirconium and titanium are determined by the salicylhydroxamic acid and cupferron methods, respectively. (auth)

24096

THORIUM DETERMINATIONS WITH 8-HYDROXYQUINALDINE. A. Corsini and R. P. Graham (McMaster Univ., Hamilton, Ont.). Anal. Chim. Acta 23, 248-56(1960) Sept. (In English)

Conditions under which thorium can be quantitatively precipitated as a 1:4 chelate with 8-hydroxyquinaldine were established. This precipitate can be dried and weighed as the anhydrous compound, $Th(C_{10}H_8ON)_4$, or dissolved in acid and the thorium determined by the dibromination of the released 8-hydroxyquinaldine. Both methods are sensitive, precise, and accurate, and have favorable analytical factors; the methods are well suited to the standardization of thorium solutions. 8-Hydroxyquinaldine has distinct advantages over the parent compound, 8-hydroxyquinoline, for the determination of thorium. (auth)

24097

THE DIRECT DETERMINATION OF URANIUM IN CONCENTRATES BY SPECTROPHOTOMETRIC TITRATION WITH FERRIC SULPHATE. T. M. Florence (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Anal. Chim. Acta 23, 282-8(1960) Sept. (In English)

A direct method is presented for the determination of uranium in concentrates by spectrophotometric titration with ferric sulphate after a bismuth amalgam reduction, the oxidation of U(IV) by Fe(III) was found to be rapid and complete at room temperature. Copper, molybdenum, and vanadium interfere to some extent, and their maximum permissible concentrations are discussed. A complete determination may be carried out in slightly more than an hour with a precision of 2 to 3 parts per thousand. An Uvispek spectrophotometer was adapted for spectrophotometric titrations without modification of the instrument. (auth)

24098

A SEMI-MICRO ANALYSIS OF SILICATE ROCKS FOR Ca, Mg, Fe, AND Al EMPLOYING E. D. T. A. Carroll Halva (Univ. of Arizona, Tucson). Ariz. Geol. Soc. Digest. 3, 81-6(1960).

A rapid, accurate analysis of total Fe, Al, Ca, and Mg in silicate rocks using EDTA as the analytical reagent was developed using semi-micro techniques. This analysis will be a great aid to the geologist and geochemist since it is time-saving, accurate, and gives approximately 80% of the composition (except SiO_2) of an average igneous rock. Another advantage of this method is that only a relatively small sample (0.2 g) is needed in order to make this determination. A sample can be fused, diluted to volume, and analyzed for these elements in approximately 3 hr. If several samples are fused at the same time, as many as eight determinations can be made in an 8 hr day. (auth)

24099

CONCERNING THE ACTIVITY DETERMINATION OF RADIOACTIVE PHOSPHORUS SOLUTIONS BY THE DEFINITE BODY CARBON METHOD. A. Skupenova and S. Hupka. Bratisl. lekárske listy 38, No. 5 II, 257-64(1958). (Translated from Referat. Zhur. Khim. No. 19, 1959, abstract No. 67228).

A determination of the absolute activity of radioactive phosphorus solutions by the definite body-carbon method is described. The method gives reproducible results within ±2%.

24100

POLAROGRAPHIC DETERMINATION OF VANADIUM IN PETROLEUM PRODUCTS. G. Zuliani and A. Delmarco. Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 104-5. (In French)

A polarographic method is proposed for determination of vanadium in petroleum derivatives. The sample is first reduced to ashes, then the ashes are taken up in H_2SO_4 solution, purified by electrolysis, and subjected to polarography in alkaline solution. An anodic step is observed which corresponds to oxidation of V(IV) to V(V). The height of the step is proportional to the concentration of the metal. This method allows a sensitivity of 20 ppm and a precision of 2%. (tr-auth)

24101

A NEW METHOD FOR DETERMINATION OF NIOBIUM AND TANTALUM. P. Reboul (Laboratoire de la S.F.A.C., Le Creusot, France). Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 109-21. (In French)

The ferro-alloys of niobium and tantalum have come to be used frequently in adding them to steels. The determination of niobium and tantalum in the ferro-alloys, as well as in the steels, has thus become a problem for the steelmaker. Existing chemical methods for separation of the Nb–Ta group and for separation of the two are long, difficult, and delicate. Research is reported on simplification of the problem. A method was sought which involved simple determination of Ta + Nb first and then the proportions of the two elements. In addition to its application in chemical analysis, the method should be of use in the metallurgy of treatment of tantalum and niobium ores to obtain a very pure mixture of the two. (T.R.H.)

24102

ANALYSIS OF NIOBIUM–TANTALUM PRODUCTS BY X-RAY FLUORESCENCE SPECTROGRAPHY. L. Meunier and W. Sergant. Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 834-7. (In French)

The first problem consisted in determining the four constituents of tantalites (Fe, Mn, Nb, and Ta) by the method of Pfeiffer and Zemany. The mineral was dissolved by the Schoeller technique and a known amount of cobalt was added to the solution to serve as an internal standard. A small quantity of the solution was put on filter paper and the intensity of suitably-chosen analytical lines was measured. The determination was done on synthetic solutions. It is shown that the precision and sensitivity of the method are satisfactory. To determine the oxide impurities, Nb_2O_5 and Ta_2O_5, the powder was used directly. In this manner the heavy metals were determined up to a concentration of about 0.5%. This method is convenient for controlling the different stages in the processing of ores, but it fails when applied to the analysis of pure oxides. In this case optical spectrography must be resorted to. (tr-auth)

24103

SPECTROGRAPHIC DETERMINATION OF ALUMINUM. P. Herman and M. Lheureux (Laboratoire de Recherches Chimiques du Ministère du Congo belge et du Ruanda-Urundi). Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 2, 735-40. (In French)

Direct determination of aluminum is always difficult by ordinary methods. It is possible to determine it by emission spectrography. A sensitive and reproducible method is given which involves chloride solutions; it uses only 2 drops for compositions ranging from 10 mg to 2 g per liter It was applied to the analysis of silicates, and it allows simultaneous determination of Fe, Ti, P, and Mn. (tr-auth)

24104

THE SPECTROSCOPIC DETERMINATION OF SMALL CONCENTRATIONS OF LANTHANUM, PRASEODYMIUM, NEODYMIUM, AND YTTRIUM IN CERIUM. Pao-lin Hsu, Lieh-fang Sheh, and Chien-hwa Cheng. Hua Hsüeh Hsüeh Pao 24, 419-25(1958). (Translated from Referat. Zhur. Khim. No. 22, 1959, abstract No. 78304).

The samples to be analyzed are dissolved as the chlorides with CeO$_2$ concentrations of 10 mg/ml. One drop of solution is dried on the flat end of a graphite electrode which has been given a preliminary coat of paraffin. The spectra are excited in an a-c arc at a current of 5 amps and recorded with a glass ISP-51 spectrograph using a UF-85 camera. For the determination of lanthanum, praseodymium, neodymium, and yttrium, the following analytical lines (in A) are used for the concentration ranges indicated in parentheses (in %): La 4333.7-Ce 4330.9 (0.055-0.62), Pr 4225.3-Ce 4229.6 (0.089-1.29), Nd 4061.1-Ce 4057.3 (0.052-0.59), and Y 4374.9-Ce 4376.9 (0.025-0.40). The error characterizing the reproducibility of the results is 5, 11, 7, and 7%, respectively. In the analysis of high-purity cerium samples, a preliminary concentration of the impurities must be carried out. This is achieved by extracting the cerium from the solution by the addition of 1 mg of Y$_2$O$_3$ per 100 mg of starting CeO$_2$ as carrier. Using the analytical lines La 4238.4, Pr 4223.0, Nd 4232.4, and the reference line Y 4235.7 A under the same excitation conditions, the following relative sensitivities are achieved: 0.01% for lanthanum, 0.025% for praseodymium, and 0.028% for neodymium. The over-all error in the analysis, taking into account the preliminary concentration, is of the order of 10%.

24105

DETERMINATION OF CARBON AND ITS RADIOACTIVITY. III. TRANSFER OF SMALL SAMPLES OF CO$_2$ TO COUNTING TUBES. Donald D. Van Slyke and John Plazin (Brookhaven National Lab., Upton, N. Y.). J. Biol. Chem. 235, 2749-52(1960) Sept.

A micromanometric modification of the ninhydrin-CO$_2$ method for determining carboxyl CO$_2$ of α-amino acids is described together with transfer of the CO$_2$ to a Bernstein-Ballentine gas counter for counting C^{14}O$_2$. The procedure serves for amounts of carboxyl carbon in the range 10 to 30 μg. When CO$_2$ is transferred from a manometric chamber to a gas counter, a small amount of CO$_2$, sufficient to be significant when the sample is less than 2 mg of carbon, may be trapped in the connecting tube between the manometric chamber and the counter. The trapped CO$_2$ can be quantitatively washed into the counter by a few milliliters of methane admitted into the manometric chamber after the usual transfer operation. (auth)

24106

SPECTROGRAPHIC ESTIMATION OF HAFNIUM AND ZIRCONIUM IN THEIR BINARY OXIDE MIXTURES. K. S. Rajan and J. Gupta (National Chemical Lab., Poona, India). J. Sci. Ind. Research (India) 19B, 341-4(1960) Sept.

A procedure is described for the quantitative spectrographic estimation of Hf/Zr and Zr/Hf ratios in binary oxide mixtures using the intermittent a-c arc excitation technique. Five selected line pairs cover the range 0.03 to 64% Hf/Zr and 0.1 to 90% Zr/Hf (wt/wt). The method was applied to the analysis of hafnia in a sample of Travancore zircon and the minor constituent in a large number of binary oxide fractions obtained in a scheme of chromatographic separation of zirconium from hafnium. (auth)

24107

ANALYTICAL PROCEDURES APPLICABLE TO FINE-GRAINED SEDIMENTARY ROCKS. Robert L. O'Neil (Pennsylvania State Univ., University Park). J. Sediment. Petrol. 29, 267-80(1959) June.

Methods are described for the determination of major and minor chemical constituents in fine-grained sedimentary rocks. They include wet-chemical methods, radiometric and flame-photometric methods, absorption and emission spectroscopic methods, and fluorescent x-ray procedures. The major elements are determined by a rapid semi-micromethod on two samples, one of which is decomposed by fusion with sodium carbonate: the other sample is decomposed by digestion with sulfuric and hydrofluoric acids. Trace elements are determined by spectrochemical procedures using internal standards. Carbon, sulfur, and the carbon present in carbonate minerals are determined by conventional methods. A fluorescent x-ray spectroscopic method for iron and molybdenum is described. (auth)

24108

THE RAPID DETERMINATION OF MAGNESIUM IN ALUMINUM ALLOYS. H. Wiedemann. Lab.-Praxis 11, No. 5, 65-6(1959). (Translated from Referat. Zhur. Khim. No. 22, 1959, abstract No. 78297).

A complexometric method for the determination of magnesium in aluminum alloys is described. 0.5 g of shavings is dissolved in 10 ml of a 25% NaOH solution; at the completion of H$_2$ evolution, 10 ml of 3% N$_2$H$_2$ · H$_2$SO$_4$ is added, the solution is heated to boiling, diluted with hot water to 100 ml, boiled for 1 min, allowed to stand several minutes, and filtered through a white-ribbon [sic] filter. The filter and beaker are rinsed 4 to 5 times with hot water, the precipitate on the filter is dissolved in hot HCl (1:1), the solution is collected in the beaker in which the precipitation was carried out, rinsed [sic] 3 times with water; the pH is adjusted to 7.2 to 7.4 by the addition of NH$_4$OH; 15 ml of a 5% solution of thioacetamide are added; the solution is allowed to stand 4 to 5 min on a hot plate, rinsed twice with water heated to 75°C; followed by the successive addition of 10 ml 1:1 HCl, 5 ml 20% KCN, 5 ml of aqueous triethanolamine (60 ml triethanolamine are diluted with water to 100 ml), 10 ml of 10% potassium sodium tartrate solution, 10 ml of buffer solution (65 g NH$_4$Cl dissolved in 450 ml NH$_4$OH); and the resulting solution is titrated with a solution of complexone (III) (15.31 g complexone III are dissolved in 500 ml of water and the solution is diluted to 1 liter) in the presence of Eriochrome Black T as indicator (1 g of dry indicator is ground in a mortar with 200 g NaCl and stored dry); the endpoint of the titration is indicated by a change of the color of the solution to pure blue. The titer of the complexone (III) solution is determined by comparison against a standard alloy sample. The method for the determination of magnesium gave good results when applied to a number of alloys of different composition

24109

DETERMINATION OF URANIUM IN ROCKS FOLLOWING ITS SEPARATION BY THE BICARBONATE METHOD. E. Upor, L. Fekete, and G. Nagy. Magyar Kém. Lapja 13, 305(1958). (Translated from Referat. Zhur. Khim. No. 19, 1959, abstract No. 67672).

From the precipitate of (NH$_4$)$_2$U$_2$O$_7$, which is obtained by the action of NH_4OH on a solution containing uranium, the uranium is usually dissolved by treatment with a carbonate of an alkali metal. However, in the presence of NH_4OH and Fe, a portion of uranium (about 60%) remains in the precipitate owing to adsorption. It was found that this defect is eliminated in the presence of $Th(OH)_4$. In the determination of uranium, prior to the precipitation with ammonia, thorium salt (20 mg thorium per approximately 6 mg uranium) is added to the solution. After 0.5 hr the precipitate is filtered off and dissolved in 50 to 70 ml of hot 5% solution of Na_2CO_3, the solution is acidified with sulfuric acid, treated with a reducing agent, and titrated with 0.005 N solution of NH_4VO_3 in the presence of phenyl-anthranilic acid as an indicator. A correction is made for dissolving iron (30 to 40 γ).

24110

THE POLAROGRAPHIC DETERMINATION OF URANIUM. K. Gyoerbiro. Magyar Kém. Lapja 13, 306-8(1958). (Translated from Referat. Zhur. Khim. No. 22, 1959, abstract No. 78317).

Data published in the literature on the polarographic determination of uranium are discussed. It is noted that as a result of the disproportionation of the U(V) formed during the polarographic reduction of U(VI), according to the reaction $2UO_2^+ + 2H^+ \rightleftharpoons UO_2^{2+} + UO^{2+} + H_2O$, the height of the wave is affected by factors related to the kinetics of the process (temperature, concentration of foreign ions, etc.); as a result, the accuracy of the method is reduced (error ±5%). The polarographic determination of uranium is not interfered with by the presence of the ions of the alkali and alkaline-earth metals, Al(III), Mn(III), Ga(III), Ni(II), and Zn(II); Fe(III) and V(V) interfere with the determination. Methods for the elimination of the interfering effect of Fe(III) and V(V) are discussed, and results from the reduction of these ions with ascorbic acid are described. The optium uranium concentration in the solution to be polarographed is 10 to 150 γ/ml; the pH of the solution is adjusted to 3.0 to 3.5 with NH_4OH or HCl. The method of additions [sic] is recommended for the determination of uranium; the polarographic analysis should be made ≤ 1 hr after the addition of the ascorbic acid. When the concentration of VO_3^- exceeds the concentration of uranium, the wave of the former is not completely suppressed, but, under the conditions described, differs sharply from the uranium wave. The possibility of the polarographic determination of trace amounts of uranium by its catalytic effect on the polarographic reduction of NO_3^- is pointed out; when the latter method is used the determination of 1 to 5 γ uranium/ml is possible after removal of interfering ions.

24111

PHYSICOCHEMICAL EFFECTS OF RADIATION. V. EFFECTS OF GAMMA RADIATION ON BOVINE FIBRINOGEN. Virgil L. Koenig, Raymond Sowinski, Lubomyra Oharenko, Vera Freling, and George C. Wei (Northwestern Univ. Medical School, Chicago). Radiation Research 13, 432-44 (1960) Sept.

The changes produced in fibrinogen when irradiated with γ rays in the dry state and in solution were observed. Sedimentation, viscosity, light-scattering, and solubility measurements were used to detect the changes. The concentration dependence of the sedimentation constant of fibrinogen was significantly decreased with irradiation. The intrinsic viscosity of fibrinogen was decreased when irradiated in the dry state. There was a decrease in solubility when the fibrinogen was irradiated in the dry state and when irradiated in solution. There was apparently considerable fragmentation of the molecule into light components as well as aggregation into heavy components. When the fibrinogen was irradiated in solution, gel formation progressively occurred. At the level of 5×10^5 r gel formation was complete. Comparisons were made with earlier results using soft x rays and high-speed electrons. (auth)

24112

METALS ANALYSIS BY RADIOACTIVATION. George H. Morrison (General Telephone and Electronics Labs., Inc., Bayside, N. Y.). p.21-30 of "Symposium on Radioisotopes in Metals Analysis and Testing. Presented at the Sixty-second Annual Meeting, Atlantic City, N. J., 1959. ASTM Special Technical Publication No. 261." Philadelphia, American Society for Testing Materials, 1960.

A method is described for the determination of minute quantities of foreign constituents in metals of ultra-high purity. This procedure, known as activation analysis, is based on the formation of artificially radioactive isotopes of the impurities. A comparison is given for the limiting concentrations of various methods of trace analysis. The described method may be used to detect impurities to 10^{-6}% concentration. The errors which affect the accuracy and precision of the activation method are discussed. There is no limit to the chemical nature of the matrix material that can be analyzed since its interference in the final measurement of the impurity element of interest can be eliminated by radiochemical separation. There is an increasing trend in the application of this method for nondestructive analysis of elements present in higher concentrations. (B.O.G.)

24113

PRINCIPLES OF ISOTOPE DILUTION ASSAYS. Charles Rosenblum (Merck Sharp and Dohme Research Labs., Rahway, N. J.). p.31-9 of "Symposium on Radioisotopes in Metals Analysis and Testing. Presented at the Sixty-second Annual Meeting, Atlantic City, N. J., 1959. ASTM Special Technical Publication No. 261." Philadelphia, American Society for Testing Materials, 1960.

Radioisotope dilution assay methods have attracted much attention since the first analytical symposium on this subject ten years ago. Isotope dilution assays of a wide variety of substances, including many biologically important substances such as vitamins, antibiotics, and insecticides, were developed. An isotope dilution assay for vitamin B_{12} is included in the first U. S. Pharmacopeia XV supplement. Conditions which must be satisfied if dilution assays are to be reliable are enumerated. Tracer radiation stability and absence of exchange action must be assured. Several variants of the isotope dilution procedure were proposed such as the double (or successive) dilution and the reverse isotope dilution methods. The derivative method, which makes use of a radioactive reagent of known specific activity, can be applied directly if quantitative isolation procedures are known or in a "derivative dilution" or reverse isotope dilution procedure. Reverse isotope dilution procedures, commonly used in biological investigations, are a convenient means for determining the purity of a labeled compound or its stability in complex media. The stability of vitamin B_{12} in dry cereals at concentrations as low as 0.46 γ per ounce was demonstrated by this method. (auth)

24114

NEUTRON ACTIVATION ANALYSIS OF TRACES OF MOLYBDENUM IN TUNGSTEN. James F. Cosgrove (General Telephone and Electronics Labs., Inc., Bayside, N. Y.). p.40-3 of "Symposium on Radioisotopes in Metals Analysis and Testing. Presented at the Sixty-second Annual Meeting, Atlantic City, N. J., 1959. ASTM Special Technical Publication No. 261." Philadelphia, American Society for Testing Materials, 1960.

A sensitive neutron activation analysis procedure for the determination of trace amounts of molybdenum in tungsten is described. The molybdenum is separated from the tungsten prior to measurement by a series of precipitations and extractions. The limit of detection of the method is 0.02 μg of molybdenum. (auth)

24115

EXPERIENCE WITH NEUTRON ACTIVATION IN THE ANALYSIS OF ALUMINUM. John E. Lewis (Alcoa Research Labs., New Kensington, Penna.). p.46-51 of "Symposium on Radioisotopes in Metals Analysis and Testing. Presented at the Sixty-second Annual Meeting, Atlantic City, N. J., 1959. ASTM Special Technical Publication No. 261." Philadelphia, American Society for Testing Materials, 1960.

Generally, aluminum does not lend itself to analysis by neutron activation. This is due to the short half life associated with Al^{28}, the main isotopic product resulting from neutron bombardment of aluminum. In performing activation analyses, the simplest and most common approach is the "comparison method." This method entails the simultaneous irradiation of the sample to be analyzed and a "standard" material of known composition. The procedures used in the analysis of aluminum for sodium and phosphorus are described. Sodium analyses exhibited a precision of better than 1%, a limiting accuracy of 0.0001%, and an average standard deviation of 0.00024% at 0.01 to 0.04% sodium concentration. It is estimated that the maximum probable errors in the phosphorus analyses values shown are 10% and 5% for low-P and high-P samples, respectively. The ultimate practical sensitivity of the method is believed to be 5×10^{-7}% phosphorus. (B.O.G.)

24116

A SPECTROSCOPIC METHOD FOR QUANTITATIVE DETERMINATION OF N^{15} IN NITROGEN. H. Zahn (Institut für Physikalische Stofftrennung, Leipzig). p.58-62 of "Optik Aller Wellenlangen." Berlin, Akademie-Verlag, 1959. (In German)

The application of the Hoch and Weisser spectroscopic method for routine isotope analysis to N_2 is reported. The method is of special interest because of the use of stable isotopes in greater quantities for labelling atoms in research and the urgent need for a simple analytical method to replace the expensive mass spectrometer. The N_2 gas mixture is put in a Rasotherm-glass discharge tube at a pressure of 2 torr and excited to emission with a small 7 MHz high-frequency generator. The N_2 spectrum is recorded with a Russian ISP-28 UV spectrograph. For evaluation the darkening curves of bandheads of $N^{14}N^{14}$ at 3159A and of $N^{14}N^{15}$ at 3162A were used. (tr-auth)

General Inorganic and Physical Chemistry

24117 ANL-6169(p.58-60)

Argonne National Lab., Ill.

THE CRYSTAL STRUCTURE OF LITHIUM TUNGSTATE. W. H. Zachariasen and H. A. Plettenger.

The complete crystal structure of lithium tungstate was determined. (auth)

24118 NAA-SR-Memo-5393

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

LEAST SQUARES TREATMENT OF DATA INVOLVING NON-LINEAR FUNCTIONAL RELATIONSHIPS. I. R. Tannenbaum and W. A. Young. June 20, 1960. 10p. OTS.

A general method is presented to give the best fit to a nonlinear equation for relating the equilibrium-hydrogen pressure of a hydride to its composition. A specialized approach involving a code for use on the IBM-709 is discussed, and code instructions are given. (J.R.D.)

24119 ORNL-1494(Rev.)

Oak Ridge National Lab., Tenn.

CHEMICAL TECHNOLOGY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING FEBRUARY 20, 1953. Apr. 10, 1953. Decl. Apr. 21, 1960. 17p. Contract W-7405-eng-26. OTS.

Work done on the following projects is reported: Purex, waste-metal recovery, Thorex, and Interim-23 processes; homogeneous-reactor fuel preparation and product recovery; Idaho chemical plant development; LITR cooling system; and studies of waste treatment, volatility, electrochemistry, ion exchange, solvent extraction, equipment decontamination, metal dissolution, coatings, and cost. (auth)

24120 ORNL-2295

Oak Ridge National Lab., Tenn.

PHASE EQUILIBRIUM DIAGRAMS FOR FUSED SALT SYSTEMS. R. E. Thoma and W. R. Grimes. July 12, 1957. Decl. May 27, 1960. 92p. Contract W-7405-eng-26. OTS.

A summary of the current status of the fused-salt systems is presented. The inclusion of a phase equilibrium diagram is not an indication that it represents a finished study. (W.L.H.)

24121 TID-6403

Anderson Physical Lab., Champaign, Ill.

PROGRESS REPORT [ON ALKALI HALIDE PURIFICATION.] Technical Report No. 12. July 1960. 13p. Contract AT(11-1)-544. OTS.

The installation and operation of a furnace in which experiments on separation of impurities from alkali halides by gas chromatography is reported. A hollow cathode apparatus, employing carbon electrodes, was designed for evaporation of salts in spectrochemical analyses. (C.J.G.)

24122 TID-6552

Michigan. Univ., Ann Arbor.

THERMODYNAMICS OF THE MONOHYDROGEN DIFLUORIDES. I. DECOMPOSITION REACTION, FUSION, PHASE TRANSITION AND ELECTRICAL CONDUCTIVITY OF β-POTASSIUM MONOHYDROGEN DIFLUORIDE. Merton L. Davis and Edgar F. Westrum, Jr. [195?]. 31p. [Project No. 5 Contract AT(11-1)-70]. OTS.

The thermophysical properties of β-KHF_2, including the enthalpy of the α-β transition (2682 ± 10 cal/mole at 196.7°C), the enthalpy of fusion (1582 ± 3 cal/mole at 238.8°C), and the enthalpy of the decomposition reaction $KHF_2 = KF + HF$ (18.52 ± 0.05 kcal/mole at 226.8°C), were determined by a direct adiabatic-calorimetric approach. These values serve as an independent test of previously reported values determined by other techniques and confirm important terms in the thermodynamic evaluation of the decomposition reaction leading to the assignment of a single minimum potential well for the proton in the $(FHF)^-$ ion. The electrical conductivity of α, β, and liquid KHF_2 was also determined. (auth)

24123 CEA-tr-R-977

CHIMIE DES BORURES. (Chemistry of Borides). G. V. Samsonov and L. Ya. Markovskiĭ (L. J. Markovsky). Translated into French from Uspekhi Khim. 25, 190-241 (1956). 24p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 1832.

24124 JPRS-5401
THERMODYNAMIC AND KINETIC FEATURES OF THE ISOTOPIC EXCHANGE REACTIONS OF HYDROGEN. (Termodinamicheskiye i Kineticheskiye Osobennosti Reaktsiy Izotopnogo Obmena Vodoroda). Ya. M. Varshavskii (Varshavskiy) and S. E. Vaisberg (Vaysberg). Translated from Uspekhi Khim. 26, 1434-68(1957). 56p. OTS.

Results of studies on thermodynamic and kinetic features of hydrogen isotopic exchange reactions are examined. Reference is made chiefly to papers that are concerned with deuterium exchange. General mathematical relations are examined, and basic equations are derived in a generalized form that is applicable to isotopes of other elements as well as deuterium. (J.R.D.)

24125 NP-tr-472
THERMOCHEMISTRY AND THE STRUCTURE OF ATOMS. I. THE THERMOCHEMICAL LOGARITHMIC RULE AND THE HEATS OF FORMATION OF HALIDES. A. F. Kapustinskiĭ. Translated by V. Beak (U.K.A.E.A. Atomic Energy Research Establishment) from Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, 568-80(1948). 26p. JCL or LC.

A thermochemical logarithmic rule is proposed which generalizes experimental data on the thermochemistry of inorganic compounds in the light of the electronic theory of atomic structure. According to this rule the heats of formation of chemical compounds are a linear function of the logarithm of the atomic number for atoms that are electronic analogues. The rule is tested, and applications are illustrated by examples from the thermochemistry of halides. See also NP-tr-473. (J.R.D.)

24126 NP-tr-473
THERMOCHEMISTRY AND THE STRUCTURE OF ATOMS. II. THE THERMOCHEMICAL LOGARITHMIC RULE AND THE HEATS OF FORMATION OF OXIDES AND HYDRIDES. A. F. Kapustinskiĭ. Translated by V. Beak (U.K.A.E.A. Atomic Energy Research Establishment) from Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, 581-9(1948). 21p. JCL or LC.

Applications and limitations of a thermochemical logarithmic rule which generalizes experimental data on inorganic thermochemistry in the light of the electronic theory of atomic structures are discussed. The rule is demonstrated by reference to data on the thermochemistry of oxides, peroxides, and hydrides. Predicted heats of formation are included for several compounds. See also NP-tr-472. (J.R.D.)

24127 UCRL-Trans-553(L)
ELECTRODELESS METHOD OF MEASURING ELECTROCONDUCTIVITY AND POSSIBILITIES OF ITS USE IN PHYSICO-CHEMICAL ANALYSIS. A. R. Regeĺ. Translated from Zhur. Neorg. Khim. 1, 1271-8(1956). 28p. (Includes original, 8p.). JCL or LC.

An analysis of the theory of electroconductivity measurement is presented along with a description of an apparatus for examining the electroconductivity and viscosity of substances at elevated temperatures. A discussion of the possibilities and application areas of this technique is included. (J.R.D.)

24128 UCRL-Trans-559(L)
ETHER EXTRACTION OF IODIDES OF HYDRIODIC ACID SOLUTIONS OF VARIOUS ELEMENTS. S. Kitahara. Translated from Kagaku Kenkyûsho Hôkoku 24, 454-7(1948). 5p. JCL.

Results are given of studies in which the iodides of several elements and the HI solutions of various compounds were ether extracted. Experimental results for the iodides are recorded and are compared with the results of other research on bromides, chlorides, and HBr solutions. Discussions of experimental methods and conclusions are included. (J.R.D.)

24129
A SYSTEMATIC STUDY OF INSOLUBLE SUBSTANCES. V. TIME AND TEMPERATURE FACTORS IN THE PRODUCTION OF INSOLUBLE SUBSTANCES. I. K. Taimni and I. S. Ahuja (Univ. of Allahabad, India). Anal. Chim. Acta 22, 128-9(1960) Feb. (In English)

It is shown that substances which become insoluble on heating begin to change into the insoluble form after passing beyond a certain range of temperature that is characteristic for each substance. Beyond this range the percentage of insoluble portion formed increases both with time and temperature. At temperatures far beyond the critical range the change into the insoluble form is very rapid. (auth)

24130
THE ORIGIN OF NUCLEI IN PRECIPITATION REACTIONS. Robert B. Fischer (Indiana Univ., Bloomington). Anal. Chim. Acta 22, 501-8(1960) June. (In English)

Data were presented which show that the particle size of a precipitate is influenced by the past history of the water used in preparing a reagent solution. On the basis of these data and previously published information it is proposed that the nucleation process in practical analytical precipitation reactions is one of induced nucleation on sites which are inevitably available. It was shown that such a mechanism is free of inconsistencies encountered with other proposals concerning the origin of nuclei. (auth)

24131
EFFECT OF FORM OF REAGENT ON PARTICLE SIZES OF PRECIPITATES. Robert B. Fischer (Indiana Univ., Bloomington). Anal. Chim. Acta 22, 508-14(1960) June. (In English)

The particle size of an ionic precipitate is much smaller when one of the reactants is introduced as a solid rather than as a solution. The effect is enhanced as the particle size of the solid reagent is decreased. The presence of a freshly dissolved inert electrolyte also influences the particle size of a precipitate. The effects are not attributable merely to the degree of supersaturation but rather to the provision by the freshly dissolved material of sites upon which nucleation can be induced. (auth)

24132
A CHLORIDE-BROMIDE URANYL OF POTASSIUM. Jacques Prigent and Jacques Lucas (Faculté des Sciences, Rennes, France). Compt. rend. 251, 388-90(1960) July 18. (In French)

A dichloride-dibromide uranyl of potassium was isolated in the anhydrous form and in various hydrated forms. It is prepared, in particular, by compression of mixtures of uranyl chloride and potassium bromide. The infrared absorption permitted the discrimination of this complex salt. (tr-auth)

24133
EQUILIBRIUM POTENTIALS OF ZIRCONIUM IN MOLTEN FLUORIDE–CHLORIDE MIXTURES. M. V. Smirnov, V. E. Komarov, and A. N. Baraboshkin (Inst. of Electrochemistry Ural Div., Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 133, 409-12(1960) July 11. (In Russian)

Equilibrium potentials of zirconium were measured at 700 to 950°C in an equimolar mixture of sodium chloride and potassium chloride with various admixtures of fluorine. The melts contained 0.17 to 1.05 wt. % zirconium and up to 15.82 wt. % flourine with the mole-fraction ratios (F/Zr) from 9 to 75. The experiments showed that in addition to a zirconium potential dependence on its concentration, it depends even more on fluorine concentration. In mixed fluoride electrolytes with high fluorine saturation, $75 > [F]/[Zr] > 10$, the mean zirconium valency $\underline{n}$ and mean number of fluorine ions in complex $\underline{m}$ fluctuate within the limits $4 > \underline{n} > 3$ and $6 > \underline{m} > 4$. In approximate calculations it is assumed that $\underline{m} = 5$ and $\underline{n} = 3.2$. (R.V.J.)

24134

THE COMPRESSIBILITIES OF CERTAIN MOLTEN ALKALI SILICATES AND BORATES. J. O'M. Bockris and E. Kojonen (Univ. of Pennsylvania, Philadelphia). J. Am. Chem. Soc. 82, 4493-7(1960) Sept. 5.

The compressibilities of the systems Na_2O-SiO_2, K_2O-SiO_2, and $Li_2O-B_2O_3$ were measured. The measurements lend support to a model of the liquids containing SiO_2 "iceburgs" at low M_2O content and discrete Si or B containing oxy-anions at high M_2O concentrations. (auth)

24135

AMMONIUM FLUORIDE–URANYL FLUORIDE–WATER SYSTEM. L. M. Ferris (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data 5, 241(1960) July.

Data and ternary isotherms were obtained on the $NH_4F-UO_2F_2-H_2O$ system at 25, 40, 59.5, and 80°C by adding excess solid UO_2F_2 to solutions initially 0.5 to 6 $\underline{M}$ in NH_4F, bringing to equilibrium, and determining the density and composition of the solution. The solid phase was identified by x-ray-diffraction analysis and found to be $(NH_4)_3UO_2F_5$ when both UO_2F_2 and NH_4F were present in solution. (D.L.C.)

24136

LEAD NITRATE–NITRIC ACID–WATER SYSTEM. L. M. Ferris (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data 5, 242(1960) July.

Data were obtained on the $Pb(NO_3)_2-HNO_3-H_2O$ ternary system at 26, 40, 59.5, and 80°C by adding excess $Pb(NO_3)_2$ to HNO_3 solutions of initial concentration 0 to 15 $\underline{M}$, bringing to equilibrium, and subjecting the liquid phase to chemical analysis and density measurements. The solid phase was identified at 25°C by x-ray analysis and at 80°C by wet residue analysis, and in both cases it was found to be $Pb(NO_3)_2$. (D.L.C.)

24137

THERMODYNAMIC PROPERTIES OF SOME GASEOUS ALKALI HALIDES. Roger L. Wilkins (North American Aviation, Inc., Canoga Park, Calif.). J. Chem. Eng. Data 5, 337-42(1960) July.

Thermodynamic functions for 10 to 6000°K are tabulated for some gaseous alkali halides. These are LiF, LiCl, LiBr, LiI, NaCl, NaBr, NaI, KCl, KBr, RbCl, and CsCl. The functions, $-(F_T^0 - H_T^0)/T$, $(H_T^0 - H_0^0)$, S_T^0, and C_p^0, were calculated on an IBM 709 computer with the Pennington and Kobe treatment for diatomic molecules, which contains first-order corrections to the harmonic oscillator-rigid rotator approximation. Effects due to isotopic mixing and nuclear spin were neglected. (D.L.C.)

24138

THERMAL DECOMPOSITION OF AMBERLITE IRA-400. Elizabeth W. Baumann (E. I. du Pont de Nemours & Co., Aiken, S. C.). J. Chem. Eng. Data 5, 376-82(1960) July.

The thermal decomposition of the hydroxide, carbonate, and bicarbonate forms of Amberlite IRA-400, a quarternary ammonium salt anion resin, was studied at ~90°C in both closed and open (simulated flowing) systems. The resins were heated in systems containing Amberlite IR-120-H, an acid cation resin, for absorbing decomposition products. The results show that, for the hydroxide form, IRA-400 in contact with H_2O at ~90°C loses 15% of its salt-splitting capacity by a reaction that is complete in the first 3 days; another and slower reaction (first-order in kinetics) that has a half life of 43 days also occurs. No difference was noted between closed and open systems. The results for the carbonate and bicarbonate forms are interpreted in terms of $CO_2-HCO_3^--CO_3^{2-}$ reactions; it is possible to obtain pure water of high resistivity from the carbonate resin, which is more thermally stable than the hydroxide form. Therefore, the carbonate form can be substituted for the hydroxide form in mixed-bed demineralizations. (D.L.C.)

24139

THE REACTION OF ATOMIC CARBON WITH OXYGEN: SIGNIFICANCE FOR THE NATURAL RADIO-CARBON CYCLE. M. Pandow, C. MacKay, and R. Wolfgang (Yale Univ., New Haven). J. Inorg. & Nuclear Chem. 14, 153-8 (1960) Aug. (In English)

The nuclear reaction responsible for producing natural radio-carbon in the upper atmosphere, $N^{14}(n,p)C^{14}$, can be duplicated in an atomic reactor. When C^{14} atoms so produced are reacted with N_2-O_2 mixtures under a variety of conditions and when corrections are made for complicating radiation induced effects CO^{14} is found to account for 90 to 100% of the C^{14} produced. This result was confirmed by work with C^{11} in much weaker radiation fields. Previously it was tacitly assumed that $C^{14}O_2$ must be the product of such a reaction. Since C^{14} as CO cannot be utilized in the photosynthetic process, suggested mechanisms for converting carbon monoxide into a chemical form suitable for entrance into the biosphere are reviewed. The relatively long mean life of atmospheric CO leads to the prediction that the specific activity of natural CO may quite possibly be greater than that of atmospheric CO_2 and therefore of the biosphere with which CO_2 is in equilibrium. (auth)

24140

REACTIONS OF GROUP Vb CHLORIDES WITH BORON TRICHLORIDE AND GALLIUM TRICHLORIDE. R. R. Holmes (Carnegie Inst. of Tech., Pittsburgh). J. Inorg. & Nuclear Chem. 14, 179-83(1960) Aug. (In English)

The complex, $PCl_5 \cdot GaCl_3$, was prepared. Several new procedures were developed for the synthesis of $PCl_5 \cdot BCl_3$, a knowledge of which allows an interpretation to be made concerning its mode of formation. The unusual properties exhibited upon sublimation of $PCl_5 \cdot BCl_3$ suggested a reversible dissociative process. Similar complexes did not form with chlorides of arsenic and antimony. (auth)

24141

HALOGEN EXCHANGE BETWEEN THORIUM(IV) IODIDE AND CARBON(IV) CHLORIDE. G. W. Watt and S. C. Malhotra (Univ. of Texas, Austin). J. Inorg. & Nuclear Chem. 14, 184-9(1960) Aug. (In English)

The reaction between thorium(IV) iodide and carbon(IV) chloride at 100 or 200°C was shown to provide a carbon(IV) chloride-insoluble product from which thorium(IV) chloride may be separated in high yield. Other reaction products identified include iodine, carbon, and trichloroiodomethane. Studies relating to the composition of the initial carbon(IV) chloride-insoluble product are described and possible interpretations of the experimental data are suggested. (auth)

24142

THE REACTION BETWEEN LITHIUM HYDRIDE AND RHODIUM TO FORM A HYDRYL. J. D. Farr (Los Alamos

Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem. 14, 202-7(1960) Aug. (In English)

The hypothesis is proposed that lithium, rhodium, and hydrogen can combine to form a new type of hydrogen compound, a "hydryl" compound. This is analogous to the known carbonyl and cyanyl compounds. The hydride ion, formed by the reaction of lithium and hydrogen, uses its electron pair to enter into co-ordination with rhodium. Some possible reactions are as follows: $4Li + Rh + 2H_2 = (Li_4RhH_4)_x$ and $(Li_4RhH_4)_x + 1/2H_2 = Li_4RhH_5$. The evidence for these reactions, consisting of power x-ray diffraction patterns and the stoichiometry, is given. The melting points of these "hydryls" appeared at 565 to 580°C. (auth)

24143

THE DENSITY OF LIQUID ALUMINUM OXIDE. A. D. Kirshenbaum and J. A. Cahill (Temple Univ., Philadelphia). J. Inorg. & Nuclear Chem. 14, 283-7(1960) Aug. (In English)

Using a molybdenum crucible and a tungsten sinker, the density of liquid aluminum oxide was determined by the loss in weight of an immersed sinker method at 2375 to 2625°K. The liquid molar volumes were calculated for various temperatures and the expansion of the oxide on melting was determined. (auth)

24144

ABSORPTION SPECTRUM OF Pm^{+3} IN D_2O, DCl. J. B. Gruber and J. G. Conway (Univ. of California, Berkeley). J. Inorg. & Nuclear Chem. 14, 303-5(1960) Aug. (In English)

The absorption spectra is reported for Pm^{3+} in 0.023 M DCl (98% D_2O) from 2600 to 19000 A under higher resolution than previously reported. Additional structure was observed in the ultraviolet region. Molar extinction coefficients were calculated for all peaks from 2600 to 8233 A. No additional peaks were observed from 8233 to 1900 A. An emission-spectrum analysis of Pm^{3+} in 1M HCl indicated impurities of Nd, Sm, Al, Ca, and Am. Following purification with Dowex-50 cation-exchange column and separation of rare-earth impurities, the column was converted to a 12N HCl column and Pm^{3+} was separated from actinide impurities. The $PmCl_3$ solution was completely dried, and 30 ml of $DCl-D_2O$ solution were added. The procedure was repeated which resulted in a final solution of $PmCl_3$ in D_2O-DCl. Measurements were made of Pm^{3+}, Cl^-, and H_2O content. A Cary 14 spectrometer was used in measuring the absorption spectra. (B.O.G.)

24145

SOME LUMINESCENCE PHENOMENA IN URANYL NITRATE. D. D. Pant and H. D. Bist (Th. D. S. B. Government Coll., Naini Tal, India). J. Sci. Ind. Research (India) 19B, 360-1(1960) Sept.

Scintillation and luminescence phenomena in uranyl nitrate hexahydrate, investigated by keeping a single crystal or mass of crystals in tubes under low pressure, appear to be connected with the pyroelectric property of the salt. Interesting differences were observed in the characteristic luminescence and fluorescence spectra of powdered samples and crystals of uranyl nitrate under pressure and uranyl nitrate hexahydrate and hexadeuterate and their slowly cooled solutions. (auth)

24146

IMPROVEMENTS IN OR RELATING TO METHODS FOR ELECTROLYTIC INTERCONVERSION OF METAL SALT SOLUTIONS. Ronald Kenneth Warner (to United Kingdom Atomic Energy Authority). British Patent 838,704. June 22, 1960.

Solutions of one salt of a metal can be converted into solutions of another salt of the same metal in one stage by electrolysis, and this method of interconversion is particularly useful for radioactive or toxic metals such as uranium. According to this method, the solution is placed on the anode side of an electrolytic cell in which a cation-permeable, anion-impermeable membrane is positioned between the anode and cathode; the acid of the second salt is placed on the cathode side of the membrane. In operation, the cation of the solution is transferred to the cathode side, forming the desired salt. Since the reaction products of the anions at the anode may be undesirable (e.g., NO_3^- gives off O_2 and H^+), a second anion-permeable, cation-impermeable membrane is placed between the solution and the anode. The efficiency of the cell can be increased by interposing granular ion-exchange material between the two membranes, whereby the internal resistance is decreased and the membrane stability is increased. Three experiments were performed on uranyl nitrate conversion to uranyl sulfate; it was found that a combination of cation- and anion-exchange resins (Zeo-Karb 225 and De-Acidite-FF) serves well as the ion-exchange material. (D.L.C.)

24147

PROCESS FOR THE PRODUCTION OF AMMONIUM URANATE. (to Deutsche Gold-und Silber-Scheideanstalt Vormals Roessler). British Patent 844,407. Aug. 10, 1960.

Ammonium uranate can be precipitated in an easily filterable form from uranate solutions by bubbling into the solution a gaseous mixture of an inert gas (e.g., air) and NH_3 of a volumetric ratio between 1:1 and 1:10. This is in contrast to other methods which give voluminous and fine precipitates not easily filtered or washed and often containing absorbed impurities. The new method minimizes entrainment of impurities from solution as is shown by the fact that a precipitate of less than 1×10^{-5}% boron was obtained from a solution containing $\sim 10^{-2}$% boron. Factors affecting the form and size of the particles are temperature, rate of precipitation, and volumetric ratio of the inert gas to NH_3 in the mixture. Two applications of the method are given. (D.L.C.)

24148

IMPROVEMENTS IN OR RELATING TO A METHOD OF CONVERTING A SOLUTION OF A RADIOACTIVE SALT INTO COMPACT SOLID FORM. Benjamin Frank Warner, James Henry Tonkin, and David Shaw (to United Kingdom Atomic Energy Authority). British Patent 846,281. Aug. 31, 1960.

A method for converting a radioactive salt solution into compact solid form is described. The method can be accomplished by remote means. The solid can be formed into a capsule suitable for teletherapeutic use. A radioactive Cs_2SO_4 solution is poured into a plutonium funnel sealed at its base with a gold foil plug, the solution evaporated by an infrared heater, and the solid and plug fused together in a furnace, after which the fusion mixture then drops into a capsule. Means for sealing the capsule are described. (D.L.C.)

Radiation Chemistry and Radiochemistry

24149 AERE-M/R-1218

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CROSSLINKING AND DEGRADATION OF PARAFFIN CHAINS BY HIGH ENERGY RADIATION. A. Charlesby. June 30, 1953. 21p.

The variation in melting point and fusibility of normal paraffins from C_7H_{16} to $C_{34}H_{70}$ was studied as a function of radiation dose and chain length. The paraffins became infusible and insoluble; the amount of radiation required to achieve this change was inversely proportional to chain length. In addition to cross-linking owing to fracture of C–H bonds, main chain fracture occurred by fracture of C–C bonds. The ratio of chain fracture to cross-linking was about 0.3. (C.J.G.)

24150 ANL-6169(p.51-7)
Argonne National Lab., Ill.
FRAGMENTATION OF HYDROCARBONS. H. E. Stanton.

The changes in the yields of fragments of normal heptane and neopentane under bombardment by electrons whose energy was varied from 70 to about 2100 ev are shown. The variation with energy and some implications are discussed. (auth)

24151 BNL-4940
Brookhaven National Lab., Upton, N. Y.
PRACTICAL METHODS OF MILKING Y^{90}, Tc^{99m}, AND I^{131} FROM THEIR RESPECTIVE PARENTS. Walter D. Tucker, Robert F. Doering, Margaret W. Greene, and Louis G. Stang, Jr. Aug. 18, 1960. 4p. OTS.

Methods for the production of carrier-free Y^{90}, Tc^{99m}, and I^{131} are briefly described. The isotopes are milked from their respective parents. (W.D.M.)

24152 CRC-941
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE RADIATION CHEMISTRY OF CYCLOHEXANE. A Detailed Progress Report [Covering Period] January 1959 to April 1960. P. J. Dyne, J. W. Fletcher, and W. M. Jenkinson. July 11, 1960. 32p.

The radiation chemistry of cyclohexane was studied. The effects of solutes on the yield of hydrogen, the formation of HD in mixtures of cyclohexane with deuterated substances, and the products formed on the radiolysis of solutions of iodine in cyclohexane were investigated. The very rapid initial reduction in the hydrogen yield occurring on the addition of 2×10^5 moles/gm of solute followed by a markedly slower reduction on further addition was observed in solutions of benzene, biphenyl, o-terphenyl, and m-terphenyl. Hydrogen yields from biphenyl solutions were studied in detail and results suggested that the biphenyl scavenged hydrogen atoms. The hydrogen yields from iodine solutions containing added benzene or diphenyl were less than those from saturated iodine solutions. Kinetic equations were developed for the yield of HD in C_6H_{12} mixtures with deuterated cyclohexane, benzene, and biphenyl. The reactivity of iodine with free radicals made it an obvious choice for radical-scavenging studies in cyclohexane. The yields of higher molecular weight products, cyclohexyl iodide, cyclohexane, bicyclohexyl, and a hitherto unreported product provisionally identified as cyclohexyl diiodide, $C_6H_{10}I_2$, were measured. At high iodine concentrations the radiation dose rate affected the yields of all products. (M.C.G.)

24153 TID-6321
Radiation Applications Inc., Long Island City, N. Y.
PROGRESS REPORT [ON RADIOINDUCED RESIN GRAFTING] FOR JUNE 1960. 4p. Contract AT[30-1]-2318. OTS.

In research on grafting methyl acrylate to nylon, methanol was found to have a large accelerative effect. In other work, investigation of grafting of silicon monomers to polyethylene is reported. Experimental results are discussed and tabulated. (J.R.D.)

24154 TID-6389
Colorado. Univ., Boulder.
RADIATION EFFECTS IN BIOCHEMISTRY AND ORGANIC CHEMISTRY. Progress Report Covering Period October 15, 1959 to July 1, 1960. 85p. Contract AT(11-1)-690. OTS.

Radiation stability studies were conducted on eleven amino acids at doses of 0 to 15×10^{-21} ev per g. Glutamic and aspartic acids were very stable, requiring ~50 ev to decompose one molecule. DL-leucine was very unstable and indicated a possible chain-decomposition mechanism. Radiation effects on pure organic compounds, resulting in loss of the starting molecule and the formation of new stable molecules, are reviewed. Results are expressed as G values. Radiation stability and optical activity of D-, L-, and DL-serine were determined. No evidence was found to indicate that Cs^{137}-source radiation causes racemization of D- or L-serine or selective destruction of either the D or L form of serine in a racemic mixture. The % decarboxylation of α-amino acids and corresponding fatty acids was determined as a function of radiation dose. The esterase and protease activities of trypsin were found to be lost at different rates when exposed to ionizing radiation. The O_{37} values for esterase and protease activities were 3.30×10^7 and 2.68×10^7 rads, respectively. A method for the determination of pool sizes and oxidation rate constants for acetate in normal and infected chick tissue with a radio Warburg apparatus was derived. The effect of influenza virus infection decreased the rate of oxidation slightly, decreased the intermediary metabolic pool, and increased the rate constant. (C.J.G.)

24155 WADD-TN-60-28
Chicago. Univ.
RADIOLYSIS OF METHANOL ADSORBED IN SYNTHETIC ZEOLITE—ENERGY TRANSFER EFFECTS. Weldon G. Brown and Helen E. Krizek. Apr. 25, 1960. 16p. Project No. 7021. Contract AF33(616)-3875. OTS.

Samples of a synthetic zeolite, containing methanol at loadings from 2 to 23%, were subjected to Co^{60} gamma irradiation. Analytical data are given for the major products, hydrogen, formaldehyde, and ethylene glycol. The data from these experiments, which were of a preliminary nature, are not sufficiently reliable to establish a significant difference with respect to product distribution as compared with the radiolysis of pure methanol. The yields indicate that a substantial fraction of the increase in total energy absorption owing to the zeolite is utilized in product formation. Under the assumption that similar mechanisms operate with efficiencies comparable with the liquid state, estimates can be made of the energy transfer efficiency. These range from 10 to 65% over the range of methanol concentrations employed and are approximately linear with respect to methanol concentration up to saturation. Reference is made to some potential practical applications of the energy transfer effect. (auth)

24156 AEC-tr-4213
RADIOLYTIC REDUCTION OF AQUEOUS SODIUM NITRATE SOLUTIONS SATURATED WITH HYDROGEN. V. A. Sharpatyi and V. D. Orekhov. Translated from Nukleonika 4, 487-9(1960). 3p. JCL and LC.

Experiments were made to determine if the presence of H_2 in aqueous nitrate solutions affects the yield of the conversion of NO_3^- at a pH of 2 to 14. (W.L.H.)

24157 CEA-tr-R-871
IMPORTANCE DES COMPLEXES EN RADIOCHIMIE. (Importance of Complexes in Radiochemistry). A. A. Grinberg. Translated into French from Zhur. Neorg. Khim. 3, 195-203(1958). 27p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13733.

24158 JPRS-5253
USSR WORKS IN THE FIELDS OF RADIOCHEMISTRY AND RADIATION CHEMISTRY. ISOTOPE EXCHANGE. A. I. Brodskii (Brodskiy). Translated from Khim. Nauka i Prom. 4, 423-34(1959). 87p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 2448.

24159
RADIOCHEMICAL SEPARATION OF ^{95}Zr AND ^{95}Nb WITH TRI-n-BUTYL PHOSPHINE OXIDE. Hirokazu Umezawa and Reinosuke Hara (Japan Atomic Energy Research Inst., Tokyo). Anal. Chim. Acta 23, 267-70(1960) Sept. (In English)

Zr^{95} and Nb^{95} behave differently on extraction from nitric acid solutions with tri-n-butyl phosphine oxide (TBPO). These isotopes can be separated efficiently by extraction with 0.005 M TBPO from 2 N nitric acid solution. Zr^{95} was extracted into the organic phase and Nb^{95} remained in aqueous phase. Separation from hydrochloric acid solution was not possible. (auth)

24160
THE SYNTHESIS OF HIGHLY RADIOACTIVE ISOPROPYL METHYLPHOSPHONOFLUORIDATE (SARIN) CONTAINING P^{32} AS TRACER ELEMENT. J. B. Reesor, B. J. Perry, and E. Sherlock (Suffield Experimental Station, Ralston, Alberta, Can.). Can. J. Chem. 38, 1416-27(1960) Sept.

Procedures are described for the safe processing of multicurie quantities of irradiated red phosphorus into isopropyl methylphosphonofluoridate (sarin) having a specific activity of 250 to 300 mc/g. The use of costly remote-handling equipment is avoided by suitable choice of synthetic route and apparatus design. (auth)

24161
A RADIOCHEMICAL TECHNIQUE FOR STUDYING RANGE-ENERGY RELATIONSHIPS FOR HEAVY IONS OF KEV ENERGIES IN ALUMINUM. J. A. Davies, J. Friesen, and J. D. McIntyre (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Chem. 38, 1526-34(1960) Sept.

A rapid technique was developed for dissolving successive thin layers of metal from the surface of an aluminum foil by electrochemical oxidation at constant voltage in aqueous ammonium citrate, followed by removal of the oxide film in a phosphoric acid—chromic oxide solution. Owing to the highly protective nature of the aluminum oxide film, this two-step process enabled very uniform surface layers of metal as thin as 1 $\mu g/cm^2$ to be removed. The total weight of aluminum dissolved increased with the applied anodic voltage at a rate of 0.30 $\mu g\ cm^{-2}\ volt^{-1}$ (approximately 11 A per volt) over the range 0 to 150 volts. The technique should be sufficiently sensitive to study the depth of penetration in aluminum of radioactive ions with kinetic energies as low as a few kev. An approximate value for the range of Na^{24} recoil atoms from the $Al^{27}(n,\alpha)$ reaction was obtained. (auth)

24162
THE POLYMERIZATION OF VINYL MONOMERS IN THE CRYSTALLINE STATE, INITIATED BY GAMMA RAYS. H. Morawetz. Chem. prûmysl 9, No. 1, 41-3(1959). (Translated from Referat. Zhur. Khim. No. 21, 1959, abstract No. 77241).

The polymerization of solid acrylamide by γ radiation was investigated. The formation of mixed crystals of acrylamide with the acetamide and amide of butyric acid increased the rate of polymerization. A kinetic analysis of the polymerization of vinyl monomers in the crystalline form is given. Rate constants for the polymerization reaction were determined. Changes in the degree of order in the lattice of the mixed crystals affect the kinetics of the polymerization.

24163
THE POLYMERIZATION OF TRIFLUOROCHLOROETHYLENE, INITIATED BY GAMMA RAYS. II. EFFECT OF PENTACHLOROETHANE ON THE RATE AND DEGREE OF POLYMERIZATION. M. Lazar and N. Kliman. Chem. zvesti 12, 627-31(1958). (Translated from Referat. Zhur. Khim. No. 21, 1959, abstract No. 77242).

The polymerization of trifluorochloroethylene in bulk and in solution at temperatures of 23 and 52° was investigated. The polymerization of trifluorochloroethylene in pentachloroethane proceeds more rapidly than in bulk. In the bulk polymerization, the rate decreases when the temperature is raised, an indication that chain propagation goes through the monomer. An increase in the temperature in the solution polymerization leads to an increase in the polymerization rate.

24164
POLYMERIZATION OF ACETALDEHYDE INITIATED BY IONIZING RADIATIONS. Claude Chachaty (Faculté des Sciences, Paris). Compt. rend. 251, 385-7(1960) July 18. (In French)

A new method of polymerization of acetaldehyde consists in the irradiation of this monomer at low temperature with x and γ rays. The thermal analysis shows that this reaction can be caused even in the solid state. (tr-auth)

24165
ACTION OF γ RAYS ON THE PHOSPHO-TRANSFERRING ACTIVITY OF VEGETABLE PHOSPHATASES. Cécile Sosa-Bourdouil and Paul Bonet-Maury. Compt. rend. 251, 427-9(1960) July 18. (In French)

The behavior of the natural phosphatase system under the action of γ rays is studied. The radioinactivation curves of dried enzymatic preparations are analyzed, and the molecular weight of the particle supporting the enzymatic activity was determined for red pepper and oat seeds. The results indicate that the experimental curves are composed of two principal parts and that the radioinactivation occurs in two stages. (J.S.R.)

24166
THE EFFECT OF IONIZING RADIATIONS OF Co^{60} ON DILUTED SOLUTIONS OF POLYMERS. H. A. Dieu. Ind. chim. belge 25, 785-90(1960) July. (In French)

A brief survey is made of the effect of ionizing radiations on polymers. The behavior of diluted aqueous solutions of polyvinyl alcohol and polyvinyl pyrrolidone under the effect of Co^{60} γ radiations was studied by viscosity, sedimentation, and reacetylation (polyvinyl alcohol) measurements. The existence of an intermolecular cross-linking mechanism for concentrations higher than the critical gelation concentrations was indicated. For diluted solutions an intramolecular cross-linking mechanism in accord with the views of Kuhn and Majer is proposed. However, the intermolecular cross-linking continues to play a very important part in the microgel formation. (auth)

24167
GAS PHASE REACTIONS OF RECOIL CARBON-14 IN ANHYDROUS AMMONIA. John Y. Yang and Alfred P. Wolf (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 82, 4488-92(1960) Sept. 5.

Radiative neutron capture reactions of nitrogen in anhydrous ammonia were studied in the gas phase. An uniquely high and specific yield of methane-C^{14} was observed. This high yield of methane-C^{14}, essentially the sole significant product from operations of the recoil carbon in gaseous ammonia was not affected by the addition of inert moderating gases. The presence of oxygen as a radical scavenger did not produce any significant effects. Reactions of the recoil carbon in the presence of methane and methylamine gave a complex mixture of radioactive products. All C^{14} systems reported to date show this behavior. A process of hydrogen abstraction is proposed to account for the apparently unique result from the operations of the recoil carbon in the presence of ammonia in the gas phase. The nature of the recoil fragments is discussed, and the possibility of a collision complex mechanism being operative is explored. (auth)

24168

THE RADIATION-INDUCED CHAIN ALKYLATION OF ETHYLENE WITH PROPANE. W. Bartok and P. J. Lucchesi (Esso Research and Engineering Co., Linden, N. J.). J. Am. Chem. Soc. 82, 4525-8(1960) Sept. 5.

The gas-phase reaction of propane with ethylene was studied in static experiments. Experiments performed using the mixed neutron-gamma radiation available from a nuclear reactor were also done thermally without radiation. Propane-rich systems containing 4.5 to 10 mole % ethylene were investigated at temperatures of 240 to 454° and initial total pressures of 9 to 20 atm. Irradiations were done at two levels of intensity corresponding to energy absorption rates of 17×10^6 and 48×10^6 rad/hr. G values exceeding 100 molecules of ethylene reacted per 100 ev establish the chain nature of the reaction. At the conditions of this work, radiation only accelerates the thermal process since the products of both the thermal and the radiation-induced reactions were very similar at the same conversions of ethylene. Changing the surface/volume ratio by packing the reactor with stainless steel wire has practically no effect. The equivalence between the radiation-promoted and thermal reactions suggests that ions and other species peculiar to radiation-initiation are not an important factor at the conditions of this work. This also means that the radiation technique can be used to gain valuable insight concerning the mechanism of the ordinary thermal reaction and indicates the chain nature of alkylation. (auth)

24169

THE CONTROLLED CHAIN OXIDATION OF n-HEXANE INDUCED BY Co-60 RADIATION. P. J. Lucchesi and W. Bartok (Esso Research and Engineering Co., Linden, N. J.). J. Am. Chem. Soc. 82, 4528-30(1960) Sept. 5.

The reaction between n-hexane and oxygen was studied at 3.4 atm total initial pressure and at a 2/1 mole ratio of hydrocarbon to oxygen. This system was studied thermally and in the presence of 10^5 and 10^6 rad/hr intensity Co^{60} radiation in static experiments. At 150 to 235°C, nuclear radiation initiates a controlled oxidation chain reaction with integral G values of 10^3 to 2×10^4 molecules of n-hexane converted per 100 ev. The products are mainly oxygenated hydrocarbons (epoxides, acetone, methanol). Above 235°C, the reaction gives mainly degradation products, CO and CO_2, and the thermal reaction is so rapid that the acceleration due to radiation is not noticeable in static experiments. This controlled chain oxidation made possible by radiation initiation is affected by temperature, pressure, and radiation intensity. Although little can be said about its mechanism, it is of intrinsic interest because it offers a technique for exploring hydrocarbon chain oxidations at conditions where the reaction is not initiated thermally. (auth)

24170

RADIATION-INDUCED CARBONIUM ION REACTIONS AND THE CHAIN NATURE OF ACID CATALYZED ISOMERIZATION. P. J. Lucchesi, C. E. Heath, and D. L. Baeder (Esso Research and Engineering Co., Linden, N. J.). J. Am. Chem. Soc. 82, 4530-3(1960) Sept. 5.

Co^{60} γ rays and x rays were found to accelerate the rate of isomerization of n-hexane and methyl cyclopentane catalyzed by $AlCl_3$. This acceleration at 30 to 50°C indicates a fairly long chain reaction. This is evident from the high radiation yields observed with Co^{60} radiation and the very high values (5×10^3) obtained with low intensity x rays. The reaction is a chain reaction for both n-hexane and MCP even at conditions where little or no decomposition or disproportionation side reaction occurs. The results offer directly measured values of the chain length for these chain reactions and tend to support the chain carbonium ion mechanism for acid catalyzed isomerization. (auth)

24171

THE REACTIONS OF RECOIL TRITIUM WITH SUBSTITUTED BENZOIC ACIDS. R. Milford White and F. S. Rowland (Univ. of Kansas, Lawrence). J. Am. Chem. Soc. 82, 4713-17(1960) Sept. 5.

Recoil tritium atoms react with substituted benzoic acids to form tritiated benzoic acid when the substituent group is $-NH_2$, $-NO_2$, $-OH$, $-COOH$, $-F$, $-Cl$, $-Br$, or $-I$. The ratio of the total radioactivity bound as benzoic acid to that bound as the parent molecule ranges from 0.02 for m-aminobenzoic acid to 0.58 for o-iodobenzoic acid. The ease of replacement increases rapidly as the bond strength of the substituent to the aromatic ring decreases. Intramolecular degradation of the benzoic acids shows that most of the tritium radioactivity substitutes into the position of the substituent. A smaller amount of the benzoic acid activity is always found in other positions than that formerly occupied by the substituent group. Labeled aniline was also isolated from irradiated aminobenzoic acids. The sensitivity to bond strength implies that chemical bonding is much more important than the physical mass of the bonded atoms or groups in determining the course of recoil tritium reactions. This sensitivity also implies that the energy at the time of reaction, although well in excess of thermal energies, is probably in the range of a few electron volts. (auth)

24172

RADIATION CHEMISTRY OF CARBOHYDRATES. PART V. THE EFFECT OF ULTRAVIOLET LIGHT ON AQUEOUS SOLUTIONS OF D-GLUCOSE IN OXYGEN. G. O. Phillips and G. J. Moody (University Coll., Cardiff, Wales). J. Chem. Soc., 3398-3404(1960) Aug.

D-Glucose is degraded when irradiated in aqueous solution with ultraviolet light. The main products, revealed by paper chromatography and estimated quantitatively by isotope dilution analysis, are arabinose, three- and two-carbon aldehydic fragments, formaldehyde, formic acid, carbon dioxide, and possibly glucosone. The degradation is examined by measuring the changes in acidity, optical rotation, and ultraviolet absorption spectra. The rates of formation of the main products with dose were measured. Hydrogen peroxide is formed continuously, and there is evidence for a post-irradiation process. The nature of the products and the quantitative measurements indicate that the degradation by ultraviolet light is different from the changes induced by γ radiation under comparable conditions. (auth)

24173

RADIATION CHEMISTRY OF CARBOHYDRATES. PART VI. ACTION OF GAMMA-RADIATION ON AQUEOUS SOLUTIONS OF D-MANNOSE IN OXYGEN. G. O. Phillips and W. J. Criddle (University Coll., Cardiff, Wales). J. Chem. Soc., 3404-12(1960) Aug.

Paper-chromatographic and radioactive-tracer methods showed that γ irradiation of oxygenated D-mannose solutions gives D-mannuronic acid, D-mannonic acid, D-arabinose, D-erythrose, two-carbon aldehydic fragments, formic acid, and carbon dioxide. Changes in acidity, absorption spectra, and the rate of formation of hydrogen peroxide were measured. Primary and secondary products are distinguished by reference to the yield-dose curves that were obtained from isotope dilution analysis and paper chromatography; there is good agreement between the two methods. Experiments using D-[1-^{14}C]mannose indicate directly that the primary degradation processes are (a) oxidation at $C_{(6)}$ and $C_{(1)}$ to give mannuronic acid and mannonic acid, respectively; (b) direct scission between $C_{(1)}$ and $C_{(2)}$ to form D-arabinose and formaldehyde; and (c) scission between $C_{(2)}$ and $C_{(3)}$ to give D-erythrose and a two-carbon aldehydic fragment with, simultaneously, direct conversion of the hexose molecule into three two-carbon aldehydic fragments. These account for 80% of the initial amount of D-mannose degraded (G 3.5). The results also indicate secondary formation of D-arabinose, D-lyxose, oxalic acid, formic acid, and carbon dioxide. (auth)

24174

SZILARD-CHALMERS REACTION IN METAL PHTHALOCYANINES. [PART] II. G. B. Cook (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 14, 301-3(1960) Aug. (In English)

The effects of postirradiation heating on the retention of Zn^{65} were studied for neutron irradiated zinc phthalocyanine and were considered to be anomalous. This behavior was traced to a peculiarity of the extraction method for the freed zinc ions from the irradiated phthalocyanine. The method of extracting the unretained metal ions consisted in refluxing the irradiated target with dilute sulfuric acid for 2 hr, filtering the solution, and estimating the amount of radioactive metal in solid and solution. This gave reproducible results although it was known that the extraction was incomplete. Further experiments were conducted using concentrated acid, diluting with ice water, and then heating at 150°C for 4 hr. The results of this extraction are tabulated. (B.O.G.)

24175

IRRADIATION OF GASEOUS AND LIQUID OXYGEN. J. F. Kircher, J. S. McNulty, J. L. McFarling, and A. Levy (Battelle Memorial Inst., Columbus, Ohio). Radiation Research 13, 452-65(1960) Sept.

Aviator's breathing oxygen was γ irradiated in the gaseous and in the liquid states under a variety of controlled temperatures, pressures, times, and dose rates. It was then analyzed for ozone and nitrogen oxides. In gaseous oxygen, ozone reached a peak concentration with 10^5 rads total dose and then decreased to steady-state concentration with 10^7 rads total dose, regardless of temperature, pressure, or dose rate. The peak and the steady-state ozone concentrations increased with increasing dose rate and decreased with increasing temperature. In liquid oxygen, ozone concentration increased linearly with total dose, regardless of dose rate or magnitude of total dose. Minimum G values for ozone formation were nine for gaseous-state and six for liquid-state irradiations. An apparent activation energy calculated from these studies suggests that the maximum and the steady-state ozone concentrations are related to a secondary atom-molecule reaction. Nitrogen oxide yields were always small, but they seemed to be significant in their effects on the mechanism of ozone formation. (auth)

24176

GAMMA RADIATION-INDUCED ISOMERIZATION OF n-PROPYL CHLORIDE. Richard H. Wiley, William Miller, C. H. Jarboe, Jr., J. R. Harrell, and D. J. Parish (Univ. of Louisville, Ky.). Radiation Research 13, 479-88 (1960) Sept.

Normal propyl chloride is isomerized to isopropyl chloride (G = 56 ± 5) by the ionizing radiation from a Co^{60} source. The corresponding reaction is not observed with isopropyl chloride. The degree of isomerization is enhanced (G = 80 ± 4) by the addition of 1 to 2 mM of hydrogen chloride gas and inhibited by traces (0.1 to 0.2 wt. %) of diphenylamine (G = 10 to 40) and di-tert-butyl-p-cresol (G = 40 to 51). The irradiation of each isomer produces hydrogen chloride (G = 4.3 ± 0.4; 4.7 ± 0.6) and small amounts of hydrogen, methane, and propane. 20 references. (auth)

24177

FREE RADICALS IN GAMMA-IRRADIATED POLYSTYRENES. Roland E. Florin, Leo A. Wall, and Daniel W. Brown (National Bureau of Standards, Washington, D. C.). Trans. Faraday Soc. 56, 1304-10(1960) Sept.

Electron spin resonance spectra were observed for γ-irradiated polystyrene and for the substituted polystyrenes a-d_1, β-d_1, p-d_1, β, β-d_2, α, β, β-d_3, m-CH_3, α-CH_3, 2,5-Cl_2, α, β, β-F_3, and 2, 3, 4, 5, 6-F_5. The spectra of all the d-substituted styrenes irradiated at 77°K were nearly identical, consisting of three peaks with a separation of 37 gauss between center and end derivative peaks. The result is consistent with a radical structure formed by removal of α hydrogen and a major hyperfine interaction with the ortho ring hydrogens. The same structure seems to apply for γ-irradiated poly(m-methylstyrene) and poly(α, β, β-trifluorostyrene), but in poly(2,5-dichlorostyrene) all hyperfine interactions are much lower. The radical from poly(α-methylstyrene) is formed by main-chain scission and shows evidence for relatively free rotation of the α-methyl group. (auth)

24178

IRRADIATION OF COTTON LIGNIN BY COBALT-60 GAMMA RAYS. S. N. Vil'kova and N. G. Murygina. Zhur. Priklad. Khim. 33, 1674-6(1960) July. (In Russian)

The lignin extracted from Asiatic cotton by alkalis was oxidized by nitrobenzene, and a separate fraction was irradiated by Co^{60} γ rays in order to establish whether or not the two treatments yield similar results. The products were identified by chromatography. The total irradiation dose reached 217 × 10^6 r. When the chromatograms were exposed to ultraviolet light, it was found that the intensity of the luminescence increases with the irradiation up to 133 × 10^6 r, after which it decreases. This is explained by the irreversible destruction of the product formed by the additional irradiation. The product was identified as vanillin. Results also show that irradiation causes deeper changes in the structure than oxidation by nitrobenzene. (TTT)

24179

THE ACTION OF IONIZING RADIATION ON SIMPLE ORGANIC COMPOUNDS. K. H. Napier and J. H. Green (Univ. of New South Wales, Kensington). p.87-94 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

The experimental technique consisted of preparing a solution of iodine containing I^{131} in the hydrocarbon. The solution was placed in an ampoule, degassed, and sealed under a vacuum. The samples were irradiated by β rays (Sr^{90}-Y^{90}) and γ rays (Cs^{137}). The irradiated mixtures were analyzed for iodonated products by gas chromatography with the use of a Geiger-Müller tube which detected only these products. Any product that did not contain iodine was neither detected nor determined. The results of iodine scavenging are tabulated for several sources. The figures given are not complete and the percentages are calculated for the products determined. Since the products determined can result from the direct splitting of the hydrocarbon, followed by iodine scavenging, these should be the only primary products. Higher iodides and polyiodides cannot result from primary processes; and, therefore, they must be at least secondary products. The higher iodides are known to be present although exactly in what form is not known. (B.O.G.)

24180

SYNTHESIS OF ORGANIC COMPOUNDS BY IONIZING RADIATION. S. Dilli and J. H. Green (Univ. of New South Wales, Kensington). p.103-16 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

There is no clear definition of the meaning of "radiation synthesis." The term is used to refer generally to the formation of identifiable compounds in a system that is absorbing energy from nuclear or high-energy radiation sources, sources of ultraviolet (uv) radiation, and spark and silent electric discharges. Photochemistry provides information only on the behavior of excited species because no ionization occurs in a system irradiated with uv and visible light. The field of radiation chemistry refers to systems which contain ionized and excited species. In this connection, radiation synthesis is defined as the formation of radiation products that are chemically and physically different from their parents in the combined effects of ionization and molecular excitation. This definition excludes all photochemical systems and leaves surprisingly few cases that can be called unambiguously "radiation synthesis." The irradiation and analytical techniques used in the synthesis of urea are described. The experiment of Loiseleur and Petit was repeated by the use of γ rays to verify the reaction mechanism and to synthesize substituted ureas. (B.O.G.)

24181

IMPROVED METHOD FOR RADIATION GRAFT COPOLYMERIZATION OF N-VINYL LACTAM MONOMERS ON ACRYLONITRILE POLYMER SUBSTRATES. (to Dow Chemical Co.). British Patent 843,063. Aug. 4, 1960.

A method is described for improving the dye-receptivity of acrylonitrile polymers by radioinduced graft copolymerization in contact with a N-vinyl lactam monomer, preferably N-vinyl pyrrolidone. The method consists of preparing the acrylonitrile polymer in aquagel form, impregnating it with a minor proportion ($< 20\%$) of N-vinyl pyrrolidone in the form of an aqueous solution, and exposing the impregnated aquagel to high-energy radiation at doses of 10^4 to 2×10^5 rep at 20 to 60°C. In order to reduce radioinduced production of O_2 and H_2O_2 in H_2O, the aqueous solution of the monomer should be kept at a pH of 7 to 10. A wetting agent, Na_3PO_4, is usually added. Experiments were performed which show the effects of dose, monomer concentration, and temperature on dye-receptivity of graft copolymers prepared in the above manner. Another experiment shows the effects on dye-receptivity of various additives ($NaHSO_3$, Na_2SO_4, Na_2S, $NaNO_3$, Na_3PO_4, NaCl, $ZnSO_4$, Na_2SO_3, and $SnCl_4$), of which $NaHSO_3$ and Na_2S were found to prevent dye-receptivity. Solvents other than H_2O which may be used to prepare monomer solutions for impregnating the acrylonitrile polymer aquagel and dyestuffs which may be used to dye the graft copolymers are given. (D.L.C.)

Raw Materials and Feed Materials

24182 CEA-1587

France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.

FORMATION DE MINERAUX NEOGENES SUR LES HALDES D'ANCIENNES MINES D'URANIUM ET SUR LE CARREAU DES MINES EN EXPLOITATION. (Formation of Neogenic Ores on the Dump-Heaps of Old Uranium Mines and on the Mine-Head of Mines under Exploitation. J. Chervet. 1960. 8p.

The major degradations suffered by primary and secondary uranium ores under the weathering action of air and water are assessed. Pyritic ores were found to be the most vulnerable. The interactions between pyrite oxidation products and uraniferous compounds often lead to the formation of neogenic ores. (C.J.G.)

24183 CEA-Note-261

France. Commissariat à l'Énergie Atomique, [Paris].

LES MATIERES PREMIERES NUCLEAIRES. ETAT DES CONNAISSANCES APRES LA CONFERENCE DE GENEVE (SEPTEMBRE 1958). (Nuclear Raw Materials. State of Knowledge After the Geneva Conference (September 1958)). May 1959. 214p.

A condensed collection is given of information on nuclear raw materials. Most of the information comes from the Second Geneva Conference, but it is updated by extracts from more recent published literature and research reports. The geology of U, Th, Be, Zr, Li, and He is discussed. Information is given on research methods and apparatus. Other data are given on reserves and resources, exploitation, concentration of ores, economics of nuclear materials, and applications of nuclear explosions in mining (~265 references). (T.R.H.)

24184 GAT-298

Goodyear Atomic Corp., Portsmouth, Ohio.

A FLUIDIZED BED OF UF_4 FOR REMOVAL OF UF_6 AND F_2 FROM A DILUTE GAS STREAM. R. P. Bell. Aug. 31, 1960. 21p. Contract AT(33-2)-1. OTS.

The study of the removal of uranium hexafluoride (UF_6) and fluorine (F_2) from a gas stream by means of a fluidized bed of uranium tetrafluoride (UF_4) was undertaken to determine the applicability of this process to gases now being vented from the feed manufacturing facility. The fluidized bed used was 4 in. in dia. with a bed depth of 7 in. Two ranges of gas concentrations were studied: the higher concentrations were approximately 5% F_2 and 0.5% UF_6, and the lower concentrations were approximately 1% F_2 and 0.05% UF_6. Nitrogen made up the balance of the inlet gas streams and was used at a flow rate of 60 scfh. with the higher concentrations and at 30 and 60 scfh. with the lower concentrations. With gas-inlet concentrations of 5% F_2 with 0.5% UF_6 it was found that at temperatures below 300°C the outlet UF_6 concentration was generally below 0.1%, and at temperatures above 350°C the outlet F_2 concentration was reduced sharply. With gas inlet concentrations of 1% F_2 with 0.05% UF_6 it was found that at bed temperatures below 250°C the outlet UF_6 concentration was generally below 0.005% and that the outlet F_2 concentration decreased with increasing temperature. During the course of the investigation the UF_4 feed rate was varied from 6.8 to 180 g/min. Within the limits studied neither the UF_4 feed rate nor the inlet gas flow rate appeared to affect the removal of UF_6 or F_2 from the gas stream. (auth)

24185 NP-9196
Eldorado Mining and Refining Ltd. Research and Development Div., Ottawa.
MONTHLY REPORT [OF] DEVELOPMENT, JULY 1960. 15p. (D-60-7).

The May mill-head samples received from Beaverlodge were carbonate-leached with synthetic leach solution under the standard conditions. Atmosphere-pressure carbonate-leach tests were performed with varied air diffusion in glass and iron leach pots. A sample of chlorite was leached by the standard atmospheric procedure to determine its sodium carbonate consumption. The effects of additives on co-precipitation of uranium and vanadium from carbonate leach liquor were studied. Amalgam reduction tests with Beaverlodge mill solutions were continued with particular emphasis on vanadium behavior. A solvent extraction separation of uranium was made of an all-RGC feed to determine the protactinium and ionium profile. (W.L.H.)

24186
PREPARATION OF URANIUM SOLUTIONS BY LEACHING DEPLETED ORES WITH RESPECT TO THE METALLURGY OF URANIUM. GENERAL CONSIDERATIONS AND RESULTS OBTAINED. A. Davister (S. A. Métallurgique de Prayon, France). Compt. rend. congr. intern. chim. ind., 31e, Liège, Belg., 1958 1, 731-6. (In French)

The low uranium concentration in the ores considered (at most several kg per tonne) necessitates production of concentrates in the immediate vicinity of the mine. The concentration process generally followed is leaching of previously ground ore with H_2SO_4, separation of the uranium-bearing solution from the pulp by filtration or decantation, and recovery of the uranium from this solution by ion exchange on resins or by extraction with organic solvents. The decantation or filtration operation is an important factor in the economy of the concentration process. The nature of each ore, the degree of grinding, the leaching method, and the requirements for using resins or organic solvents all impose severe conditions to which the method of decantation or filtration must be adapted. The problems arising in application of known filtration techniques to the particular case of uranium concentration are studied, and the results of one industrial application are presented. (tr-auth)

24187
MULTISTAGE FLUIDIZED BED REACTOR. (to U. S. Atomic Energy Commission). British Patent 845,655. Aug. 24, 1960.

A multistage fluidized-bed reactor for converting UO_3 to UO_2 and UF_4 by H_2 and HF, with the solid flowing downward and the gas flowing upward to fluidize the solid, is designed so that when the gas flow stops the solid flow will also stop. This is accomplished by baffles which permit the upward gas flow and stop the downward solid flow when the gas flow is shut off. The baffles are located below the plates or cones constituting stages, and gas nozzles are installed nearby to prevent blocking of the space between the plates and the baffles. Three configurations of such a fluidized-bed reactor are given; one was operated successfully in two 13-hr runs in UO_2 conversion to UF_4. (D.L.C.)

Separation Processes

24188 CF-60-8-127
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE PROGRAM: INFORMATION FROM HAPO ON CENTRIFUGE DECONTAMINATION AND FUEL STORAGE CANAL WATER CLEAN-UP. O. F. Hill. Aug. 30, 1960. 3p. OTS.

Information on decontamination of centrifuges used with highly radioactive solutions and criteria for fuel-storage-canal water clean-up are presented in the form of questions and answers. (J.R.D.)

24189 HW-61577
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RECOVERY OF PLUTONIUM FROM CHLORIDE SLAG AND CRUCIBLE. R. C. Smith. Aug. 14, 1959. Decl. Mar. 25, 1960. 20p. Contract AT(45-1)-1350. OTS.

Flowsheets outlining the recovery of Pu from chloride slag and crucible were developed. Chloride is reduced to 35 ppm. The method is adaptable to recovery of other Pu-bearing salts such as those obtained in the electrolytic reduction of Pu or Pu refining in fused-salt baths. (J.R.D.)

24190 HW-62842
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SHEAR DEVELOPMENT FOR THE NONPRODUCTION FUEL REPROCESSING PROGRAM. Interim Report. V. P. Kelly. July 1, 1960. 42p. Contract AT(45-1)-1350. OTS.

The size reduction of fuel elements by shearing was investigated for the power-reactor fuels processing program at Hanford. A 40-ton hydraulic guillotine shear was used to cut simulated and unirradiated fuels, and parameters of shear force, blade life, and properties of the sheared product were studied. Results show that a shear of 200 to 350 tons capacity is required to shear the largest present-day fuels, with size dependent largely on blade geometry and velocity. For the shear, conventional Si-Mn tool steel blades will cut in excess of 10 tons (U weight) of fuels per blade. During shearing, short fuel pieces (1 in. or greater in length) can be produced with cladding open at the ends. This allows acid-leaching of fuel core material. Significant quantities of dust, including submicron particles, will also be produced in shearing, particularly for oxide fuel. Dust containment studies are continuing for control and collection of shear dust. (auth)

24191 HW-64172
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
MULTI-PURPOSE DISSOLVER INFORMATION MANUAL. H. P. Simonds. Mar. 4, 1960. 13p. Contract AT(45-1)-1350. OTS.

The design of a multipurpose dissolver and associated equipment is presented. The dissolver was designed to provide (1) a critically safe vessel for dissolving uranium metal of enrichments up to 1% U^{235}, (2) a vessel which can be charged with fuel elements up to 10 ft long, (3) an off-gas arrangement which will eliminate return of NH_3 to the dissolver during the Zirflex decladding process, (4) a vessel in which small charges can be dissolved without using extra chemicals, and (5) a bypass routing around the silver reactor during cladding removal. (W.L.H.)

24192 HW-66191
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
TECHNOLOGY OF NON-PRODUCTION REACTOR FUELS

REPROCESSING BUDGET ACTIVITY 2790. Quarterly Report. V. R. Cooper. Aug. 8, 1960. 12p. Contract AT(45-1)-1350. OTS.

Fabrication was completed for a shear-basin system designed to demonstrate an effective system for "dust" control in the NPF mechanical cell. The use of a steam sparge as the motivating force for recirculation during Zirflex dissolutions was demonstrated in the pilot-plant dissolver (5.5M NH_4F–0.5M NH_4NO_3). Modifications to the Zirflex process for the dejacketing of zirconium-clad fuel elements are described. The Sulfex process was selected for the decladding of stainless-steel-clad fuel elements. Methods for depassivating stainless steel were studied. In studies of air-lift induced recirculation through UO_2 packed beds, the improbability of obtaining adequate liquid flows when air is introduced below the bed was demonstrated. (For preceding period see HW-65267.) (C.J.G.)

24193 ORNL-2951
Oak Ridge National Lab., Tenn.
DESIGN AND SCALEUP OF MIXER-SETTLERS FOR THE DAPEX SOLVENT EXTRACTION PROCESS. A. D. Ryon, F. L. Daley, and R. S. Lowrie. Oct. 5, 1960. 73p. Contract W-7405-eng-26. OTS.

The basis for design and scale-up of mixer-settlers for the Dapex solvent extraction process was determined by a unit operations study in scale model units. Rate constants for uranium extraction involving stage efficiency, phase ratio, and residence time are directly proportional to the cube root of power input in the mixer. Typical mixing requirements for 90% stage efficiency are 30 hp/1000 gal and 2 min residence for extraction and 0.7 hp/1000 gal and 1.5 min for stripping. The scale-up of geometrically similar mixers is based on constant specific power input. The flow capacity of gravity settlers is limited by a dispersion band, which increases exponentially with flow rate. The scale-up of settlers is based on constant flow rate of dispersed phase per unit settler area and constant band thickness. The nominal flow capacity (50% of flooding) of the dispersed phase is approximately 1 gpm/sq ft of settler area. Emulsions and solvent entrainment are minimized by control of mixing to form solvent-continuous dispersions. Operating data from two uranium mills confirm the scale-up relations over a range of flow rates of 200-fold for mixers and 1000-fold for settlers. (auth)

24194 TID-6357
Ionics, Inc., Cambridge, Mass.
PROGRESS REPORT [ON SOLVENT EXTRACTION] FOR PERIOD COVERING JULY 16–AUGUST 15, 1960. Aug. 16, 1960. 15p. Contract AT(30-1)-2470. OTS.

The effects of the nitrate ion (at levels of 0.016M to 0.64M) and the chloride ion (at levels of 0.028M to 1.12M) on Th recovery by the amine procedure were studied. Thorium recovery was not effected until nitrate concentration exceeded about 0.35M and chloride concentration exceeded 0.70M. A comparison of the amine and ceric iodate procedures for recovering Th from various solutions revealed excellent agreement between the two methods. An analysis of the same solutions for Ra by the ionics and Idaho Falls procedures gave results varying from good to quite poor. The presence of Ra^{224} complicated the analysis. (For preceding period see TID-5893.) (C.J.G.)

24195 CEA-tr-A-684
LA SÉPARATION DU PROMÉTHIUM DE MACROQUANTITÉS DE SAMARIUM. (Separation of Promethium from Macroquantities of Samarium). D. Naumann and W. Heyne. Translated into French from J. prakt. Chem. (4) 8, 28-32 (1959). 11p.

After previous separation of most of the Sm on a mercury cathode, the separation of Pm by ion exchange becomes possible. A study was made of the conditions for electrolytic separation of Sm as well as chromatographic separation. (T.R.H.)

24196 CEA-tr-R-866
SÉPARATION DES ÉLÉMENTS RARES PAR LA MÉTHODE D'ÉLECTROPHORÈSE CONTINUE. I. SÉPARATION À L'AIDE DE L'ACIDE CITRIQUE. (Separation of Rare Earths by Continuous Electrophoresis. I. Separation Using Citric Acid). V. P. Shvedov and A. V. Stepanov. Translated into French from Radiokhimiya 1, 112-15(1959). 13p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 5271.

24197 JPRS-5150
COPRECIPITATION OF Pu(IV) WITH ORGANIC COPRECIPITANTS. V. I. Kuznetsov and T. G. Akimova. Translated from Atomnaya Energ. 8, 148-50(1960). 8p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 11540.

24198 UCRL-Trans-523(L)
ION EXCHANGE CHROMATOGRAPHIC SEPARATION OF RADIOISOTOPES OF RARE-EARTH ELEMENTS. A. K. Lavrukhina, F. I. Pavlotskaya, A. A. Pozdnyakov, and I. M. Grechishcheva (Greshishsheva). Translated by Esther S. Goldberg from Zhur. Neorg. Khim. 3, 82-7(1958). 14p. (Includes original, 6p.). JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13807.

24199
ANION EXCHANGE STUDIES OF URANIUM(VI) IN SULPHATE AND CARBONATE SOLUTIONS. SEPARATION FROM MIXTURES. Shripad M. Khopkar and Anil K. De (Jadavpur Univ., Calcutta). Anal. Chim. Acta 23, 147-51 (1960) Aug. (In English)

The anion exchange behavior of uranium(VI) in two important leach systems, sulfate and carbonate, is described. Hydrochloric, nitric, sulfuric, and perchloric acids and sodium chloride, ammonium chloride, sodium nitrate, and sodium sulfate were tested as eluants on a Dowex 21K column. In the sulfate system uranium is separated from fission-product elements (e.g., cerium, zirconium, cesium, silver, cadmium, and from vanadium); in the carbonate system, it is separated from phosphate and molybdate.(auth)

24200
SEPARATION OF THORIUM FROM RARE EARTHS ON FN CATION EXCHANGERS. K. Vetejška (Institut für Erzforschung, Prague). Collection Czechoslov. Chem. Communs. 25, 1895-1900(1960) July. (In German)

The pattern of the sorption of thorium and some rare earths from sulfuric and hydrochloric acid solutions was followed on FN cation exchangers. On the basis of the variations established in the sorption of the elements selected, a method was proposed for the separation of thorium from rare earths from dilute sulfuric acid solutions. (tr-auth)

24201
SOLVENT EXTRACTION IN EXTRACTIVE METALLURGY. J. M. Fletcher (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Compt. rend. congr. intern. chim. ind., 31ᵉ, Liège, Belg., 1958 1, 34-9. (In French)

A review is presented of the use of 4-methyl-2-pentanone, bis(2-butoxyethyl)ether, and tributyl phosphate in extractive metallurgy. In recent years, developments were found not only in the use of these three solvents in separation and purification of several non-ferrous metals, but also in the use of two new groups of solvents applicable to industrial use; these are amines for extraction of anionic complexes and alkyl phosphoric acids for cationic complexes. An intense study was made of these two groups from the point of view of their use for extraction of uranium from ore leach liquors. The chemical and physical properties for organic solvents useful in liquid-liquid extraction are surveyed, and details are given for typical examples. The development of each liquid-liquid extraction process is followed step-by-step from laboratory to pilot plant. Predictions are made of future uses of liquid-liquid extraction in extractive metallurgy outside the nuclear energy field. (T.R.H.)

24202

THE SEPARATION OF VANADIUM FROM URANIUM SALTS. B. S. Brčič and D. Kolar (Institut "Josef Stefan," Ljubljana, Yugoslavia). Compt. rend. congr. intern chim. ind., 31^{e}, Liège, Belg., 1958 1, 670-1. (In German)

The conditions were established under which, by simple acidity control, vanadium can be removed from uranium concentrates. The separation is never complete for some vanadium is found in the filtrate, and some uranium is found in the vanadium precipitate. A study was made of the effect of changing the starting concentration of the solution or the pH at which the vanadium precipitates on the completeness of separation. Also studied was the dependence of the precipitation rate of hydrated V_2O_5 on the concentration and pH of the solution. (tr-auth)

24203

USE OF SLIGHTLY ALLOYED URANIUM AS FUEL: ITS EFFECTS ON DISSOLUTION AND OTHER PHASES OF RETREATMENT. P. Faugeras, P. Leroy, and C. Lheureux. Compt. rend. congr. intern. chim. ind., 31^{e}, Liège, Belg., 1958 1, 672-9. (In French)

A study was made of the problem of treatment of binary alloys (U-Al, U-Mo, U-Zr, U-Cr, and U-Si) with a low content of another element ($\leq 2\%$). The object was the utilization of plants for treating irradiated nonalloyed uranium with a minimum of modification. First, the normal processes for treatment of irradiated uranium by solvent extraction are reviewed; then selective dissolution of the cladding is studied, followed by a study of the behavior of different alloys during the normal processes of dissolution, extraction, final treatment of fission products, and final plutonium purification. The possible alloys are then classified according to the difficulties each causes in normal treatment. (tr-auth)

24204

THE SEPARATION OF A FRACTION OF RARE EARTHS FROM THE FISSION PRODUCTS OF U^{235}. V. Knobloch and Z. Urbanec. Compt. rend. congr. intern. chim. ind., 31^{e}, Liège, Belg., 1958 1, 684-6. (In German)

The application of paper electrophoresis to separation of rare earths from the fission products of U^{235} is shown. The separation is satisfactory in a buffer solution of 0.2M citric acid in the pH range 2.2 to 3.0. The sequence is given for La, Ce, Pr, Nd, Pm, Sm, Y, Tb, and Ho; methods of identification are given. (tr-auth)

24205

SOLVENT EXTRACTION OF PLUTONIUM IN THE SYSTEM OF TRI-n-BUTYL PHOSPHINE OXIDE-CARBON TETRACHLORIDE AND NITRIC ACID SOLUTION. Hirokazu Umezawa (Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 2, 478-82(1960) Aug. (In English)

The distribution ratio of Pu(IV) and Pu(III) between nitric acid solution and tri-n-butyl phosphine oxide solution diluted with carbon tetrachloride was determined in the range of nitric acid concentration from 0.5M to 10M and tri-n-butyl phosphine oxide concentration from 1×10^{-4}M to 3×10^{-1}M. It was found that plutonium can be easily extracted from the irradiated uranium under the suitable conditions of extraction. (auth)

24206

DISTRIBUTION BEHAVIOR OF NEPTUNIUM AND PLUTONIUM BETWEEN ACID SOLUTIONS AND SOME ORGANIC EXTRACTANTS. Boyd Weaver and D. E. Horner (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data 5, 260-5 (1960) July.

The extractive properties of some organonitrogen and organophosphorus compounds for neptunium and plutonium in aqueous acid solutions were investigated under the following conditions: (1) The acid was generally HNO_3 although H_2SO_4 and HCl were also studied. (2) The valence of neptunium and plutonium was generally (IV) although Np(V) and (VI) and Pu(III) and (VI) were briefly studied. (3) The extractants were (a) salts of primary, secondary, and tertiary amines and quaternary ammonium salts and (b) dialkyl phosphoric acids, neutral phosphates, and phosphine oxides. The results show extraction maxima for the (IV) state at 2 N HNO_3 by tertiary amines and at 8 N HNO_3 by the other amines. Increasing the nitrate ion concentration at constant acidity increases extractability by amines, and extractions of the (IV) state are greater from HNO_3 than from H_2SO_4 except for primary amines. Extraction of the (IV) state by organophosphorus extractants from HNO_3 varies in the order dialkyl phosphoric acid > phosphine oxide ≫ neutral phosphate. The use of the results to derive methods for separating neptunium and plutonium from solutions and from each other is discussed. (D.L.C.)

24207

DINONYL NAPHTHALENE SULPHONIC ACID AS A LIQUID CATION-EXCHANGER FOR COMPLEX STUDIES. J. M. White, P. Tang, and N. C. Li (Duquesne Univ., Pittsburgh). J. Inorg. & Nuclear Chem. 14, 255-61(1960) Aug. (In English)

The extraction of Co(II), Zn(II), Mn(II), Fe(III), and In(III) into heptane containing dinonyl naphthalene sulfonic acid (HD), from aqueous perchloric acid solutions, was investigated with the use of the radioactive tracer technique. The distribution coefficients for M(II) and M(III) are inversely second and third power, respectively, dependent upon the hydrogen ion concentration in the aqueous phase, and directly first power dependent upon the HD concentration in the heptane phase. The formation constants of In(III) complexes of glycolate, bioxalate, and Co(II) complexes of bioxalate were determined by use of HD in heptane as a liquid cation-exchanger. For Co(II)-bioxalate it was demonstrated that the formation constants agree with values obtained by using resinous cation-exchanger. Since the use of liquid ion-exchanger permits an analysis of the aqueous and non-aqueous phases, whereas in resinous cation-exchange experiments it is not convenient to analyze the non-aqueous phase, it is of decided advantage to demonstrate that the liquid ion-exchanger can be used for complex studies. (auth)

24208

THE SEPARATION OF PROMETHIUM FROM BULK SAMARIUM. D. H. W. Naumann. J. prakt. Chem. (4) 8, No. 1-2, 28-32(1959). Translated from Referat. Zhur. Khim. No. 21, 1959, abstract No. 74448).

A method is described for the separation of Pm^{147} from a samarium proton-synchrocyclotron target without the use of a carrier. The initial separation was carried out by electrolysis at a mercury cathode. Optimum conditions were a concentration of 50 mg Sm_2O_3 per ml electrolyte, containing 190 mg/ml potassium citrate, pH 5 to 6, cathodic current density 50 ma/cm^2, temperature 0 to 5°, and renewal of mercury at 1-hr intervals. After 4 hr the solution contained 99.5% promethium and only 8% samarium. The final separation was carried out by ion exchange in a column packed with Dowex-50 or KPS-200 resin in the NH_4 form. Elution was carried out with trihydroxyglutamic acid or with lactic acid.

24209
THE ENRICHMENT OF LOW-PHOSPHATE RAW MATERIAL IN RARE EARTHS. B. Borkowski. Przemysł Chem. (N. S.) 13, 604-6(1957). Translated from Referat. Zhur. Khim. No. 21, 1959, abstract No. 75407).

The feasibility of the enrichment in rare-earth elements of precipitates formed during the neutralization of one of the hydrogens in technical H_3PO_4 with ammonia and containing 0.52% rare-earth elements was investigated. 20 g of the precipitate obtained was dissolved in dilute HCl (1:1), the solution was brought to boiling, 20 g of urea was added, and the solution was heated for 3 hr over a boiling water bath. The precipitate obtained was subjected to fractional reprecipitation. The fraction obtained at pH 1.5 to 2.1 showed an 11-fold enrichment in rare-earth elements.

24210
CONCERNING THE EFFECT OF CERTAIN AMIDES ON THE ELECTRICAL CONDUCTIVITY AND ABSORPTION SPECTRA OF URANYL NITRATE SOLUTIONS IN TRIBUTYL PHOSPHATE. Stefan Minc and Lidia Werblan. Roczniki Chem. 32, 1419-23(1958). (Translated from Referat. Zhur. Khim. No. 19, 1959, abstract No. 67353).

The viscosity and electrical conductivity of 0.02M solutions of $UO_2(NO_3)_2$ were determined in 1M solutions of formamide, N-methylformamide, acetamide, N-methylformamide, tributyl phosphate, and in amide-tributyl phosphate mixtures. Calculation of the degree of dissociation of $UO_2(NO_3)_2$ showed that it dissociated significantly in formamide and N-methylacetamide solutions. Amides increased the degree of dissociation of the $UO_2(NO_3)_2$ in solutions of tributyl phosphate from 1 to 2.5%. Investigations of absorption spectra of the solutions in the visible region established that dissociation of $UO_2(NO_3)_2$ gave rise to a storage uranyl absorption band and to a shift in the band maximum from 416 to 424 mμ. It was assumed that these phenomena were associated with a substitution of amide molecules for nitrate ions or tributyl phosphate molecules in the uranyl coordination sphere. (M.C.G.)

24211
THE CONCENTRATION OF LOW-GRADE EGYPTIAN GRAPHITE. H. A. Sinbawi, K. Orphy, and F. Bedewi. Rudy (Prague) 7, No. 6, 206-8(1959). (Translated from Referat. Zhur. Khim., No. 5, 1960, abstract No. 18417)

The concentration of low-quality graphite (composition in wt. %: C 19.2, SiO_2 39, $CaCO_3$ 32.2, Fe_2O_3 5.5) was studied by flotation methods. The effect of the fineness of grinding on the yield of concentrate was studied with 500-gm samples of which 55, 65, 75, 78, 80, and 83% pass through a sieve with openings of 0.074-mm diameter. The flotation time was 10 min. Best results were obtained with fractions in which 78 and 80% of the particles pass through the sieve. The yield of concentrate for these cases was 68.9 and 60.62%, respectively, and the carbon content was 39.1 and 42.3%, respectively. The optimal collector appeared to be crude petroleum (1,250 gms/ton). The best flotation reagent was found to be pine oil (290 gms/ton). The flotation proceeded best in a neutral or weakly alkaline medium. An increase in the concentration of solids in the suspension slightly decreased the yield of concentrate. The addition of small amounts of Na_2CO_3 or Na_2SiO_3 to the solution did not improve the yield. The repeated flotation of concentrate containing 55% carbon gave a product containing 63.6% carbon. This product was ground and mixed with a small amount of mineral oil; water was used as the medium in the flotation which gave a concentrate containing up to 85% carbon.

24212
IMPROVED URANIUM VANADIUM RECOVERY PROCESS. (to United Kingdom Atomic Energy Authority). British Patent 843,092. Aug. 4, 1960.

An improved method is outlined for recovering uranium and vanadium from acid leach solutions obtained from carnotite and roscoelite ores. The method consists of reducing uranium to the 4+ state and vanadium to the 3+ state (in a solution acidified with HCl to a pH < 0.5) by iron metal for 2 hr at 90°C, adding PO_4^{3-}, and adjusting pH to 1.0 and then to 2.8 for precipitation of uranium and vanadium phosphates, respectively; both precipitation steps are carried out at 90°C. The uranium phosphate may be converted to a UO_2 cake by an alkaline metathesis step (preferably carbonate fusion at 900 to 950°C), and the vanadium phosphate can serve as an efficient scavenger of uranium left in the solution after uranium phosphate precipitation. The method applied to a carnotite process solution gave 95.7% recovery of uranium. (D.L.C.)

24213
IMPROVEMENTS IN AND RELATING TO URANIUM EXTRACTION PROCESSES. (to Commissariat à l'Energie Atomique). British Patent 845,842. Aug. 24, 1960.

A method is outlined for separating uranium from leach alkali carbonate solutions obtained from uranium ores, e.g., shales. The method consists of the following steps: (1) ozone is passed into the solution at 20°C for 10 to 15 min, and the solution is filtered with powdered filtering aids; (2) the solution, pH 9.5 to 11.5, is introduced into a basic anion exchange column of the quaternary ammonium type, e.g., Amberlite IRA 410, the uranium being fixed in the form of a tetravalent uranyl carbonate complex; (3) when the column is saturated with uranium, the uranium is eluted with an aqueous solution of NaCl or $NaNO_3$, the eluant is acidified, and $CaCl_2$ or $Ca(NO_3)_2$ is added to precipitate insoluble calcium salts; (4) after filtration and adjustment to a uranium content of 40 to 80 g/l and an acidity of 0.1 N, the uranium is extracted with an immiscible solvent, e.g., a mixture of paraffin and tributyl phosphate; and (5) the uranium extract is washed with water to form an aqueous solution of uranyl chloride or nitrate, which may be concentrated by evaporation to give the final solution. The ozone used in (1) serves the dual purpose of oxidizing impurities and coagulating colloidal particles. The eluant from (2) is recycled for use in leaching uranium ore, and the aqueous phase from (4) is recycled as the eluant for eluting uranium as in (3). (D.L.C.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

24214 AERE-R-3391
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

DESIGN AND ENGINEERING PROBLEMS OF THE SPENT FUEL ELEMENT IRRADIATION PONDS AT A.E.R.E., HARWELL. J. W. Mark. July 1960. 35p. BIS.

A storage pond for spent fuel elements is described in which the highly active fuel elements can be employed as sources for irradiation experiments. Demineralized water is used as the shielding medium. Filtration, lighting, and the transfer-port system are described. Equipment for fuel-element canning and remote handling is discussed. (C.J.G.)

24215 APAE-66
Alco Products, Inc., Schenectady, N. Y.
SCALE "UP OR DOWN" ANALYSIS FOR PROTOTYPE TEST. May 1, 1960. 74p. Contract AT(11-1)-666. OTS.

An analysis of the factors involving scaling "up or down" a prototype test unit of a 70 Mw sodium intermediate heat exchanger and a sodium steam generator was made. The size, heat load, and flow considerations which led to the final design are analyzed. To prove the reliability of the 70 Mw design, it is recommended that the unit be fabricated and tested at 50% of heat load. The "scale up" analysis is demonstrated by a design which increased the size of the 70 Mw heat exchanger to 225 Mw. Drawings showing major dimensions and material thicknesses required for the 225 Mw designs are presented. A comparison of the 70 and 225 Mw designs showed diameter and length changes in all units except the steam drum. (C.J.G.)

24216 CF-60-3-164
Oak Ridge National Lab., Tenn.
DEVELOPMENT TESTING AND PERFORMANCE EVALUATION OF LIQUID METAL AND MOLTEN SALT HEAT EXCHANGERS. R. E. MacPherson and M. M. Yarosh. Mar. 17, 1960. 43p. OTS.

Development testing was done on prototype, bifluid (molten salt—NaK) salt exchangers and on liquid-metal (NaK-air) radiators in support of the ANP program. The molten salt was a Na-Zr-UF_4 mixture, and the NaK was 56 wt.% Na and 44 wt.% K. Performance tests were conducted on prototypes of the main heat exchangers for the Aircraft Reactor Test. The flow range on the molten-salt side of the exchanger varied from Reynolds numbers of 1000 to 6000, and the NaK-flow operating range varied from Reynolds numbers of 15,000 to 200,000. Data were taken on 20-, 25-, and 100-tube bundles at start-up and after 500 and 1000 hr of operation. No deterioration of the salt coefficient occurred with time of operation. In general, the data were found to lie ~40% below the Dittus—Boelter line in the Reynolds range of interest. The effects of tube spacer arrangements on the unit performance were investigated. Pressure-drop data are presented for 1.75- and 0.5-Mw Aircraft Reactor Test prototype radiator units. (C.J.G.)

24217 NP-9184
North Carolina State Coll., Raleigh.
LUBRICATION BEHAVIOR OF LIQUID METALS. Progress Report No. 7 [for] May 1960 to August 1960. Patrick H. McDonald. Aug. 1960. 23p. Project No. 8-(8-7022). Contract AF33(616)-5885.

The assembly and check-out of the hydrodynamic-lubrication test apparatus (liquid metal and Argon loops) was completed. A method for obtaining a level suspension system for the test bearing was developed. A trolley system for moving the assembled bearing housing into and out of the support piping was designed and built. The fabrication of an apparatus to evaluate the effectiveness of liquid metals in the boundary-lubrication region was completed. (C.J.G.)

24218 SCTM-184-60(25)
Sandia Corp., Albuquerque, N. Mex.
ENCLOSURE AND SEALING METHODS. G. S. Wallace. July 25, 1960. 22p. OTS.

Several methods of obtaining an effective seal are described. Information is presented which will facilitate the proper selection of method and materials compatible with design requirements. Only general information on sealing methods and materials is presented. Empirical data on specific materials and applications should be obtained from the Sandia Corporation Materials Standards Department. (auth)

24219 TID-6341
General Atomic Div., General Dynamics Corp., San Diego, Calif.
OUT-OF-PILE LOOP FOR HELIUM PURIFICATION TESTING. R. H. Stone. Jan. 26, 1960. 15p. Project No. 32. Contract AT(04-3)-314. (GAMD-1205). OTS.

The design and cost estimates on an out-of-pile loop for studies in He purification and coolant system component testing are presented. The loop would operate at 300 psia, gas compressor inlet and maximum heater test section temperatures of 600 and 2200°F, respectively, graphite surface temperature of 2600°F, and a gas flow Reynolds Number in the heater test section of 20,000. (C.J.G.)

24220 JPRS-5278
THE PROBLEM OF STRENGTHENING HIGH-PRESSURE CONTAINERS. M. G. Gonikberg, D. S. Tsiklis, and A. A. Opekunov. Translated from Doklady Akad. Nauk S.S.S.R. 129, 88-90(1959). 8p. OTS.

The design of a high-pressure container which is made of two layers is presented. The outside layer consists of an elastic band and the inside layer is made up of several hard wedges. This high-pressure vessel is capable of withstanding pressures higher than ordinary vessels. (W.L.H.)

24221
SEALING AGAINST PRESSURE AND VACUUM. Brit. Chem. Eng. 5, 652; 654; 656; 658(1960) Sept.

Reviews are given of several papers concerning sealing applications in pressure and vacuum systems. In high pressure joints there are two parts (the seal and the coupling). The seal requires a constantly maintained contact pressure, which is reduced if the coupling is insufficiently rigid to withstand deformation or if creep occurs; the seal then becomes ineffective. Except where pressures are very high, temperature is likely to present the more serious problems. Few nonmetallic materials last long at temperatures above 200°C. Some experiences in the application of mechanical seals to pumps and stirred pressure vessels are discussed. This type of seal is generally available for pressures to 1500 psig and temperatures to 250°C; higher temperatures are permissible through the use of separate cooling systems. The factors that affect the tightness required in valve applications are discussed. In "high vacuum closures," rolled plate or forgings are used for vacuum tightness because castings are porous. The best valve seats are rubber to metal or PTFE to metal; the metal must have a lapped and polished finish and must be kept clean. (B.O.G.)

24222
THE INFLUENCE OF THE INITIAL CONDITIONS ON THE PRESSURE DECREASE DURING IONIC PUMPING. L. Pátý and P. Schürer. Czechoslov. J. Phys. 10, 536-43(1960). (In Russian)

A description is given of the experimental investigation of the influence of the initial pressure and method of outgassing an evacuated system on the pressure decrease during pumping with an ionization gage. Measurements were carried out in a system containing two ionization gages and two valves using the method of cascade pumping. Conclusions as to the influence of these conditions on the pressure decrease were reached, and the causes of this influence are discussed. (auth)

24223

THE STRENGTH OF NUCLEAR REACTOR VESSELS. Jaroslav Němec (Inst. of Railway Engineering, Prague). Jaderná energie 6, 254-66(1960). (In Czech.)

The analysis of strength limits of large pressure vessels is given. Static properties of materials and classical calculation methods are not decisive for a safe determination of strength. The relations for the shape strength factor of bodies and for the strength limit determination leading to a progress of sudden critical rupture are derived. The directions for vessel design and their manufacture follow from the analysis. (auth)

24224

PROCEEDINGS OF THE [(I.U.T.A.M.)] SYMPOSIUM ON THE THEORY OF THIN ELASTIC SHELLS, DELFT, 24-28 AUGUST, 1959. W. T. Koiter, ed. Amsterdam, North-Holland Publishing Company and New York, Interscience Publishers, Inc., 1960. 501p. $9.00.

Included are the 23 papers presented at the International Symposium on the Theory of Thin Elastic Shells, Delft, August 1959. The papers were limited to two major topics in which research is currently particularly active, viz., the non-linear theory of shells and the investigation of problems lacking axial symmetry. In the interest of an effective discussion, participation in the Symposium was strictly limited to about 70 invited experts from 13 countries. The papers and discussions contributed to a better understanding of the essential problems in this field. (B.O.G.)

24225

IMPROVEMENTS IN OR RELATING TO ROTARY SELECTOR VALVES. Everett Long and John Raymond Gurner (to Plessey Co., Ltd.). British Patent 837,443. June 15, 1960.

A rotary selector valve is designed which is of small diameter compared with the number of ports and is accessible for maintenance without disconnecting any pipes. Further, places at which possible dilution of gas being sampled can occur are restricted to two (sealing ring and ring) as compared with 52 such places in an alternative system. (D.L.C.)

24226

IMPROVEMENTS IN WATER-TUBE STEAM GENERATORS. Andre Huet. British Patent 838,672. June 22, 1960.

A water-tube steam generator for nuclear power installations was invented with all the elements e.g., economizer, evaporator, and superheater supported in such a way that heat expansion or contraction can take place without damaging the means of support. The invention consists of suspending the elements from each other like a chain with stay bars or rods and attaching the top element (usually the central element of the superheater) to the casing conduit with three stay bars. (D.L.C.)

24227

IMPROVEMENTS IN STEAM GENERATING INSTALLATIONS. Andre Huet. British Patent 838,742. June 22, 1960.

A steam generating installation is proposed having the economizers, evaporators, and superheaters for two-stage steam arranged as elementary heat exchangers so that all the members of one set of the three are grouped together in separate elements. For example, the hot coolant enters successively the elements containing the high-pressure superheater and evaporator, the element containing both the high-pressure economizer and the low-pressure superheater, and finally the elements containing the low-pressure evaporator and economizer. Thus, there are five separate elements of the heat exchanger. The advantages of such an arrangement are that construction of the elements is easier and the temperature limits of these elements are narrower. (D.L.C.)

24228

IMPROVEMENTS IN OR RELATING TO FLUID FLOW VALVE MECHANISMS. (to Westinghouse Electric Corp.). British Patent 843,317. Aug. 4, 1960.

A valve of the drain-and-fill type is designed for nuclear power stations, especially the liquid metal cooled type. The advantage of the design is that a seal of mass spectrometric tightness is possible without self-welding of the valve members due to the cleaning action of the liquid metal. The valve comprises a T-shaped housing with a valve port of circular cross sectional area and a hollow head 0.002 to 0.004 inch larger in diameter than the port; a low-temperature fluid flows into the hollow space of the head. To close the valve, the hollow space coolant shrinks the head sufficiently to seat it securely in the port, and then the coolant flow is interrupted, which allows the head to return to ambient temperature and thus to effect a tight seal. To open the seal, the cooling procedure is repeated. The head and mating port preferably have a slight taper of 1 to 2°, and the valve closing mechanism is of the hydraulically actuated servo type. (D.L.C.)

24229

IMPROVEMENTS IN OR RELATING TO GAS BEARINGS. Albert George Montgomery (to United Kingdom Atomic Energy Authority). British Patent 846,742. Aug. 31, 1960.

A simple method of reducing the porosity of porous gas-bearing sleeves in order to eliminate shaft vibration owing to excessive gas turbulence is given. The method consists of coating the porous surface with shellac dissolved in a volatile solvent, e.g., methylated spirit. It is pointed out that it is easier and cheaper to produce sleeves of coarse porosity and subsequently reduce the porosity by painting than to produce sleeves of the required porosity. (D.L.C.)

24230

IMPROVEMENTS IN OR RELATING TO HEAT INSULATION DEVICES. Everett Long (to United Kingdom Atomic Energy Authority). British Patent 846,753. Aug. 31, 1960.

The problem of heat insulation in sodium-cooled graphite-moderated reactors employing re-entrant cooling (hot and cool sodium are kept in header tanks on top of the reactor core and separated from each other by a diaphragm) is solved by constructing the diaphragm out of alternate layers of hexagonal and diamond-shaped steel tiles. In this way, thermal expansion is allowed for, and the temperature difference in the diaphragm is only 25°C for a temperature difference of 200°C between the tanks. (D.L.C.)

Heat Transfer and Fluid Flow

24231 JPLAI-LS-177

California Inst. of Tech., Pasadena. Jet Propulsion Lab. TWO-PHASE FLOW AND ACOUSTIC PHENOMENA IN GASES AND LIQUIDS. Astronautics Information Literature Search No. 177. Rowena Rodabaugh. June 1960. 29p. Contract NASw-6.

Abstracts are presented on 127 papers pertaining to two-phase flow and acoustic phenomena in gases and liquids. (C.J.G.)

24232 KAPL-M-NPA-15
Knolls Atomic Power Lab., Schenectady, N. Y.
BHT-M: AN IBM DIGITAL COMPUTER PROGRAM TO CALCULATE BOILING HEAT TRANSFER OF STEAM GENERATORS. H. Harden. July 7, 1960. 32p. Contract W-31-109-Eng-52. OTS.

An IBM computer program, BHT-M, for calculating the boiling heat transfer of steam generators is described. The program is written in Fortran II. Program output consists of heat transfer length, overall length of the horizontal U-tube steam generator, and hot and cold leg temperatures. (C.J.G.)

24233 TID-7529(Pt.2)
Nuclear Development Corp. of America, White Plains, N. Y.
REACTOR HEAT TRANSFER CONFERENCE OF 1956. Collected Papers and Reports of a Conference Held at New York, November 1 and 2, 1956. John E. Viscardi, comp. Nov. 1956. Decl. Mar. 31, 1960. 24p. OTS.

Boiling burnout test results are described for forced-circulation, bulk boiling heat transfer to high-purity water in a 0.192-in. horizontal annulus of 1.43 in. inside diameter and 21-ft heated length. A description is provided of the electrically heated experimental facility used and of details of test procedure which cover conditions of pressure from 590 to 2010 psia, heat fluxes from 133,000 to 378,000 Btu/hr/sq ft, mass flow rates from 610,000 to 1,700,000 lb/hr/sq ft, and outlet-steam qualities up to 44.4 wt. %. (auth)

24234 UCRL-9280
California. Univ., Berkeley. Lawrence Radiation Lab.
HEAT TRANSFER TO FLOWING GAS–SOLIDS MIXTURES IN A VERTICAL CIRCULAR DUCT (thesis). Creighton Arthur Depew. July 11, 1960. 103p. Contract W-7405-eng-48. OTS.

The problem of heat transfer to an air stream laden with solid spherical particles flowing up a vertical tube with constant heat flux was examined. Two different particle sizes were used, 30 and 200 μ. The air rate was held constant at Reynolds number = 13,500 and 27,400 while solids were added up to gravimetric ratios of seven. The analytical treatment parallels the solution for single-phase flow. An approximate solution is obtained when it is assumed that the difference in the temperature of the two phases is small, and that the radial temperature profiles of the two phases in the fully developed region are similar. Nusselt numbers are based on the local tube wall and bulk mean-mixture temperatures. Qualitative agreement with the experimental results was obtained. The analysis predicts that when solid glass particles are added to the air stream in increasing numbers, the asymptotic Nusselt number decreases to a minimum and then increases. The experimental results show that the Nusselt number remains constant for loading ratios <0.5 and decreases to a minimum which occurs between 1.0 and 1.5. The length of the thermal entry region increases with increasing solids to gas ratios and was found to be longer than the heat-transfer tube (46.4 pipe diameters) at a loading ratio of unity. Although the analysis predicts an increasing Nusselt number at ratios greater than 2, the experiments with 200-μ particles show that the Nusselt number is independent of the solids loading. Friction factors calculated from over-all pressure-drop measurements predict heat-transfer coefficients, according to Reynolds analogy, that agree with experimental values within 20% for solids loadings less than 0.5. (auth)

24235 JPRS-3512
BOILING HEAT TRANSFER OF LIQUID METALS. Chi-fang Lin, Yu-ch'i Yang, Fan-kuo K'ung, Kuei-ch'en Hseing, and Chia-hsiang Wang. Translated from K'o Hsüeh T'ung Pao, 832-3(1959). 4p. OTS.

Experiments were conducted on boiling mercury and magnesium under various pressures. Pure mercury under standard pressure gives the film type of boiling. The experimental value is greater than Bromley's theoretical heat-transfer value of the film type. Pure mercury boiling under pressure gives nuclear-boiling characteristics, but the effect of pressure on thermal coefficient is opposite to that of ordinary liquids. The addition of a small quantity of magnesium improves the permeability and also the heat-transfer efficiency. The change of pressure does not affect greatly the heat transfer of the Mg–Hg system. (W.L.H.)

24236 NP-tr-464
HEAT CONDUCTIVITY OF GASES. (Teploprovodnost' Gazov). V. S. Chirkin. A translation of p.33-43, Chapter III of "Teploprovodnost' Promyshlennykh Materialov; Spravochnoye Posobiye," 1957. 21p. OTS.

Equations are presented for calculating the quantity of energy transmitted in a unit of time through a unit of area. The heat conductivity, viscosity, and amount of heat for H_2, Ar, He, N_2, O_2, and CO_2 are presented. Coefficients of heat conductivity of superheated water vapor are presented. (W.L.H.)

24237
HEAT TRANSFER STUDIES BETWEEN PARTICLES AND LIQUID MEDIUM IN A FLUIDIZED BED. Narsimha Rao Sunkoori and Ramalingam Kaparthi (Osmania Univ., Hyderabad, India). Chem. Eng. Sci. 12, 166-74(1960).

The heat-transfer coefficients between the particles and the fluidizing medium under unsteady state conditions were determined by transient heating of a cold water stream with hot solid particles dropped into the fluidizing bed in a specially designed liquid fluidizing column. Heat-transfer coefficients varying from 113 to 620 Btu/hr/ft^2/°F are obtained, and these values increase with increase in particle diameter and mass velocity. The present data are also compared with previous published data on gas-fluidized beds. (auth)

24238
HEAT TRANSFER TO NON-NEWTONIAN FLUIDS UNDER LAMINAR-FLOW CONDITIONS. A. B. Metzner and D. F. Gluck (Univ. of Delaware, Newark). Chem. Eng. Sci. 12, 185-90(1960).

Rates of heat transfer to non-Newtonian fluid systems passing through smooth round tubes under laminar flow conditions were studied, both experimentally and theoretically, for the case in which viscous heat generation may be neglected. The data of three independent investigators were correlated with an average deviation of 16%. The final equation contains the conventional Grashof number type of correction to account (empirically) for natural convection effects and the Sieder–Tate correction for radial variation of fluid consistency. Up to 37% of the total heat was transferred by natural convection even in systems that were highly non-Newtonian in nature. (auth)

24239
TRANSFER FROM A SPHERE INTO A FLUID IN LAMINAR FLOW. M. Linton and K. L. Sutherland (Commonwealth Scientific and Industrial Research Organization, Melbourne). Chem. Eng. Sci. 12, 214-29(1960).

Boundary layer theory and experimental results for the transfer of heat and mass from spheres in forced flow are compared over the range of conditions $1 < Re < 1.8 \times 10^5$, $0.5 < Pr < 10^6$, $2 < Nu < 540$. The over-all and local solution rates of $^3/_8$-in.-diameter spheres of benzoic acid were measured in uniform flow in a water tunnel at $490 < Re < 7580$. The over-all transfer was correlated by $Nu = 0.582\ Re^{1/2} Pr^{1/3}$. The relative distribution of local transfer rates over the front half of the sphere was in fair agreement with theory and other workers, but the absolute local values at the front stagnation point were about 40% lower than theory and differed considerably among other workers. The discrepancies may in part be due to a gradual transition from viscous flow to potential flow outside the boundary layer as Re increases from 1 to 10^5. The relative transfer from the rear half of the sphere was observed to increase with Re. The angle of separation θ_s, found experimentally, varies approximately according to $\theta_s = 83 + 191\ Re^{-1/2}$. The average transfer rate over the front of the sphere is theoretically proportional to $Re^{1/2} Pr^{1/3}$. Over the whole sphere $0.5 < Nu\ Re^{-1/2}\ Pr^{-1/3} < 1.0$ for $10^2 < Re < 10^5$. The approximation is only rough because of the factors dependent on Re mentioned above and the following secondary factors. These latter are a lower limit to transfer rate set by diffusion or conduction, density convection unless $Gr \ll Re^2$, turbulence and/or non-uniformity of the free stream, interference from sphere supports, influence of duct walls, uncertainty in transfer properties of fluids, variation of fluid properties with concentration or temperature, and dust accumulation on the sphere. (auth)

24240

FLOW OF A VISCOUS CONDUCTING FLUID BETWEEN TWO POROUS PLANES. N. P. Dzhorbenadze and D. V. Sharikadze (Razmadze Tbilis Mathematical Inst., Academy of Sciences, USSR, Georgian SSR). Doklady Akad. Nauk S.S.S.R. 133, 299-302(1960) July 11. (In Russian)

The problem of viscous, incompressible, electroconducting flow in a space between two parallel porous planes with a uniform constant external magnetic field applied perpendicularly to the planes was investigated. The main stream is assumed to pass parallel to the planes. The fluid simultaneously enters one plane and flows out through the other; thus the amount of the incoming and outgoing liquid remains constant. (R.V.J.)

24241

OBSERVATIONS ON BOILING CARBON TETRACHLORIDE FROM SURFACES. Robert L. Nickelson and George W. Preckshot (Univ. of Minnesota, Minneapolis). J. Chem. Eng. Data 5, 310-15(1960) July.

Experimental heat transfer measurements were made on the boiling of CCl_4 with the effects of adsorbed or dissolved gases eliminated by fractionation of CCl_4. The surface roughness was held constant in an effort to study the effects of the chemical nature of the surface. The heat-transfer surfaces were 18-gage solid Cu, 20-gage solid Cu, Ag, and Au wires, and 18-gage Cu wires vapor-coated with Au, Ag, or Cu; and they were also used as resistance thermometers. The pressures for boiling CCl_4 were 0.5, 1, and 1.5 atm. Nonboiling natural convection heat transfer data were collected first, and then nucleate pool-boiling heat-transfer data were collected at ~ 50% burnout. In the latter experiment, the boiling heat flux curves shifted with boiling time toward higher temperature excesses together with a slight tarnishing of the surfaces. For Au there was no shift and for Ag only a slight shift; but there was a very definite shift for Cu. The wire diameter appears to have no effect on nucleate boiling flux. Superheat data indicated that extraneous sources of nuclei (gases and dust particles) were removed successfully. Nuclei count data are presented as a function of pressure excess; the nucleate contribution is independent of pressure excess for a given pure-metal surface. (D.L.C.)

24242

IMPROVEMENTS IN FUEL ELEMENTS FOR NUCLEAR REACTORS. Bernard Nelson Watts and Maurice Arthur Cayless (to British Thomson-Houston Co., Ltd.). British Patent 842,317. July 27, 1960.

A method is given for establishing good thermal contact between the outer fuel container and the fuel, keeping the interior gas pressure between container and fuel low so that the gaseous coolant pressure will force the container and fuel together. Since uranium absorbs a considerable quantity of H_2, which is then evolved on heating, this method can be accomplished by including inside the can some material capable of absorbing large quantities of H_2, (Ti, Th, Zr, La, Ce, Nb, V, and Ta). For uranium canned by Magnox alloy, the preferred material is a disk of niobium at one end of the uranium bar. (D.L.C.)

24243

IMPROVEMENTS IN OR RELATING TO HEAT EXCHANGERS. Everett Long and Reginald John Symes (to United Kingdom Atomic Energy Authority). British Patent 846,754. Aug. 31, 1960.

A heat exchanger of the shell and tube type was invented for heat exchange between primary liquid sodium and secondary liquid sodium. The heat exchanger unit is removable and free to move axially to allow for thermal expansion. (D.L.C.)

Instrumentation

24244 AERE-EL/R-2717

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A PRECISION RELAY PULSE GENERATOR FOR USE WITH PULSE AMPLITUDE ANALYSERS. M. O. Deighton. May 1960. 28p. BIS.

The design and operation of a pulse generator for use with pulse amplitude analyzers are discussed. The fluctuating contact potentials are ~100 μv and can be operated reliably up to 75 cycles. The pulse-shaping network is designed with an impedance of 500 ohms. (C.J.G.)

24245 AERE-R-3302

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A FAST NEUTRON COUNTER FOR DOSIMETRY. J. A. Dennis and W. R. Loosemore. June 1960. 23p. BIS.

A fast neutron counter, consisting of a series of polyethylene-lived cells with a common anode wire and filled with a mixture of Ar and CH_4, is considered. The counting rate of the proton-recoil proportional counter is directly proportional to the estimated biological dose due to fast neutrons in the range 0.1 to 15.0 Mev so that the counting rate is $0.9 \pm 0.18\ c\ sec^{-1}$ per maximum permissible level of fast neutron flux. The minimum pulse size at the counter anode with an applied potential of 1400 v corresponded to the collection of $5.5 \pm 2.5 \times 10^6$ ion pairs. (C.J.G.)

24246 ANL-6169(p.1-3)

Argonne National Lab., Ill.

ARGONNE FAST-NEUTRON VELOCITY SELECTOR. L. M. Bollinger, R. E. Cote', and G. E. Thomas.

A rotor of new design was constructed and is now in use, replacing the original rotor used principally for the measurement of partial cross sections. The construction and characteristics of this rotor are discussed. (auth)

24247 ANL-6169(p.35-7)
Argonne National Lab., Ill.
LINEAR-MOTION GENERATOR FOR MÖSSBAUER EXPERIMENTS. J. Baumgardner.

The use of low-frequency loudspeaker mechanisms for providing accurately controlled motion of sources of absorbers in Mössbauer experiments is discussed. A suitable driving amplifier is shown and the performance of the system is described. (auth)

24248 ANL-6169(p.38-40)
Argonne National Lab., Ill.
NEUTRON CROSS SECTIONS BY SELF-DETECTION. C. M. Huddleston, J. E. Monahan, and F. P. Mooring.

The efficiency of the counter assembly used in self-detection measurements was measured by use of a gas scintillation counter as a fission detector. A further check was made by use of a properly collimated long counter. (auth)

24249 AWRE-NR/P-2/60
United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
A PULSE NUMBER SORTER (TYPE 160). W. G. Gore and T. Ring. Aug. 1960. 16p.

An apparatus is described for making statistical analyses of neutron counts in a reactor. The apparatus converts the number of pulses received in a certain time interval into a proportional pulse amplitude from which the output pulses can then be sorted in a pulse-height analyzer. (C.J.G.)

24250 CNC-38
Italy. Comitato Nazionale per le Ricerche Nucleari, Rome.
BINARY AND DECIMAL TRANSISTORIZED SCALERS. (Scale di Demoltiplicazione a Transistori Binarie e Decimali). D. Brini, A. Gandolfi, and G. L. Tabellini. June 1960. 14p.

Binary and decimal scalers are described. They are mounted with printed interchangeable circuits employing commercial transistors. The resolving time is better than 1 μsec within a wide range of temperatures. (auth)

24251 GAMD-1229
General Atomic Div., General Dynamics Corp., San Diego, Calif.
AN APPARATUS FOR MEASURING THE THERMAL CONDUCTIVITY OF GRAPHITE AT HIGH TEMPERATURES. W. V. Goeddel. Jan. 10, 1959. 6p. Project No. 32. Contract AT-(04-3)-314. OTS.

A comparative method for rapidly measuring the radial thermal conductivity of graphite and graphite fuel bodies over the temperature range 900 to > 2200°C is described. An apparatus was built and operated, and thermal conductivity values are presently being obtained on HTGR fuel materials. (auth)

24252 GAT-T-783
Goodyear Atomic Corp., Portsmouth, Ohio.
OPERATING EXPERIENCE WITH ION PUMPS ON MASS SPECTROMETERS. V. E. Schupbach. Aug. 25, 1960. 12p. Contract AT(33-2)-1. OTS.

Ion pumps for high-vacuum applications on mass spectrometers were investigated. Operating conditions obtained with commercial ion pumps indicate that pumps of this type are in many ways superior to mercury diffusion pumps for high vacuum. Operational data are included. (auth)

24253 HW-65178
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
L/R INDICATOR. G. C. Minor. May 20, 1960. 9p. Contract AT(45-1)-1350. OTS.

The L/R indicator was designed for determining the ratio of inductance to resistance of an electrical component. The complete circuit incorporates a meter to measure resistance and to indicate the trigger pulse when calibrating. When measuring air-core coils the results will be accurate within a few %, comparable to most testing devices and bridges available. (W.L.H.)

24254 IS-167
Ames Lab., Ames, Iowa.
A HIGH-TEMPERATURE VACUUM EXTENSOMETER. J. R. Bohn and Glenn Murphy. July 1960. 23p. Contract W-7405-eng-82. OTS.

An autographic extensometer for use at temperatures up to 1000°C is described. Strain information is obtained from within a high-vacuum enclosure by application of linear variable-differential transformers. Typical high-temperature stress-strain records for U and Ta are included to illustrate the performance of the equipment. (auth)

24255 LMSD-288140(Vol. I)(Paper 1)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
THERMIONIC THEORY AND TECHNIQUE. J. E. Cobb, W. H. Cutler, and A. F. Dugan. Paper 1 of GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME I. 25p.

This paper was originally published under the same title as LMSD-311695, dated Sept. 1959.

The vacuum diode as a means of producing power by thermionic emission was studied theoretically with respect to efficiency and power. Experimental results, however, indicate that no simple theory is adequate to predict the effect of interelectrode space charge. The parameters which govern the magnitude of the space charge also affect the specific power and efficiency. A simultaneous analysis of space charge, specific power, and efficiency is required to predict effectively cell performance and to facilitate cell design. If the analysis can be made to agree with the experiment, in general, a large part of the experimental program may be circumvented and more time devoted to the search for basic information concerning thermionic phenomena. The agreement already achieved between the actual experiment and a theory which embraces the cathode electron effect upon space charge is presented. (auth)

24256 LMSD-288140(Vol. I)(Paper 5)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
A THERMAL-ELECTRONIC CONVERTOR. J. E. Cobb and W. H. Cutler. Paper 5 of GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME I. 31p.

This paper was originally published under the same title as LMSD-5106, dated Jan. 2, 1959.

It is shown that thermionic power cells capable of delivering 5 watts/cm^2 at an efficiency of near 25% with a hot surface temperature of 1700°K are theoretically possible. The same cell, with a sacrifice in efficiency, can deliver more than 40 watts/cm^2; this can be accomplished by the reduction of potential difference across the cell. The performance of a thermionic power cell is very sensitive to the design parameters and imposed operating characteristics. Most of the significant parameters affecting thermionic emission are examined. (W.D.M.)

24257 LMSD-288140(Vol. I)(Paper 6)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
METALLIC CARBIDES AS EMITTER MATERIALS IN THERMAL-ELECTRONIC CONVERTORS. G. C. Kuczynski. Paper 6 of GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME I. 23p.

The recent work on the emission from metallic carbide cathodes is critically reviewed. The analysis of the existing data may indicate that the anomalies in emission characteristics are caused by some surface transformations whose nature at present is difficult to ascertain. Recommendations for future work are given. (auth)

24258 NAA-SR-5354
Atomic International. Div. of North American Aviation, Inc., Canoga Park, Calif.
A MULTICHANNEL DIGITAL RECORDING SYSTEM. R. W. Truitt. Sept. 15, 1960. 21p. Contract AT-11-1-GEN-8. OTS.

A 200 channel digital recording system which is used to record high-temperature strain gage outputs and associated temperatures is described. The system is capable of monitoring temperatures and slow transient strains from 68 to 1150°F. Automatic system self-checking features are incorporated. (C.J.G.)

24259 NARF-60-18T
Convair, Fort Worth, Tex.
PERIOD CALIBRATOR. Bruce Richerson. Aug. 15, 1960. 21p. Contract AF33(600)-38946. (MR-N-246).

The design and operation of the period calibrator, an instrument which provides a known input to log-N amplifiers and period meters for test and calibration purposes, is described. The period calibrator produces a linearly varying voltage for calibrating the differentiating circuit of a period amplifier and an exponentially varying current for testing and calibrating the logarithmic circuit of the period amplifier. (C.J.G.)

24260 NP-9008
Battelle Memorial Inst., Columbus, Ohio.
EXPERIMENTAL AND RESEARCH WORK IN NEUTRON DOSIMETRY. Final Summary Report for the Period May 15, 1959—June 15, 1960. H. C. Gorton, O. J. Mengali, A. R. Zacaroli, R. K. Crooks, J. M. Swartz, and C. S. Peet. June 15, 1960. 113p. Contract DA-36-039-SC-78924.

A practical, prototype silicon p-n junction fast-neutron dosimeter, sensitive in the same range as human tissue, was developed, together with an associated read-out circuit to facilitate the accurate measurement of accumulated dose. From both theoretical and experimental considerations, it was demonstrated that the dosimeter is essentially insensitive to the gamma and thermal components of a uranium fission spectrum. It was shown that accumulated damage effects appear to be environmentally stable up to an ambient temperature of 100°C. A rather marked reversible temperature dependence of the read-out parameters requires either control of the read-out temperature or temperature compensation in the read-out device. A high degree of reproducibility of dosimeter characteristics from one device to another was not achieved. The lack of reproducibility was attributed to uncontrolled variables in the bulk silicon from which the devices are fabricated, and in the production procedure. (auth)

24261 NP-9057
Washington Univ., St. Louis.
STUDY OF SYSTEM FOR PHOTOGRAPHY OF A LIQUID HELIUM BUBBLE CHAMBER (thesis). Technical Report No. 6. Paul Aikin Smith. May 1960. 63p. Contract NONR-816.

The theory, construction, and performance of a photographic system for a one liter helium bubble chamber are described. Of primary interest are (1) the contrast between bubble image and background fog on the photographic film as a function of bubble size and (2) the ability to distinguish between adjacent bubbles in the chamber. (W.D.M.)

24262 NP-9201
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
HIGH TEMPERATURE STRAIN AND TEMPERATURE SENSING DEVICES. A Preliminary Literature Survey. A. A. Beltran, comp. May 9, 1960. 50p. (SB-60-3).

This bibliography lists and abstracts some of the literature-sensing devices in the temperature range from ambient to 1500°F. It also briefly covers measurement techniques, adhesives for the strain and temperature-sensing instruments, and these instruments applied specifically to beryllium, pyrolytic graphite, steel, and titanium. (W.L.H.)

24263 ORNL-2912
Oak Ridge National Lab., Tenn.
SOME X-RAY AND FAST NEUTRON RESPONSE CHARACTERISTICS OF SILVER METAPHOSPHATE GLASS DOSIMETERS (thesis). W. T. Thornton and J. A. Auxier. Sept. 1, 1960. 59p. Contract W-7405-eng-26. OTS.

Submitted to Vanderbilt Univ.

A study was conducted to determine the adequacy of silver metaphosphate glass as a dosimeter for γ radiation coexistent with fast neutrons. The fast-neutron response in the energy region encompassing a major portion of the fission spectrum was determined and a method of decreasing the photon-energy dependence was developed. The size of the dosimeter and reproducibility of results make this system a useful addition to γ-ray dosimetry, particularly for γ rays coexistent with neutrons. In some experiments the greatly increased sensitivity to low-energy photons permits accurate measurement of exposure doses as small as a few hundred milliroentgens. (auth)

24264 SCDR-100-60
Sandia Corp., Albuquerque, N. Mex.
A ONE-AMPERE CONSTANT CURRENT DEVICE. R. W. Farrell. Apr. 1960. 5p. OTS.

The design intent, characteristics, and intended use of a one-ampere constant-current device are presented. (auth)

24265 SCR-168
Sandia Corp., Albuquerque, N. Mex.
HIGH-SPEED AUTO-DATA SYSTEM FOR BLAST STUDIES. R. D. Jones and J. D. Smith. July 1960. 10p. Contract AT(29-1)-789. OTS.

Presented at the 1960 Conference Proceedings of the 4th National Convention on Military Electronics.

A multichannel high-speed automated system for recording digitally the outputs of the analog transducers used in the study of blast effects from small HE charges is described. Test phenomena associated with these studies are recorded in 10 to 40 msec. Installation and operation of this data handling system are described. (J.R.D.)

24266 SCR-190
Sandia Corp., Albuquerque, N. Mex.
MATERIALS AND PROCESS VARIABLES AND THEIR EFFECT ON CONTACT RESISTANCE. L. K. Jones. May 1960. 18p. OTS.

Presented at Pennsylvania State University Engineering Seminar, June 7, 1960 and ASTM Annual Meeting, Atlantic

City, New Jersey, June 27, 1960. Prepared for presentation from SCTM-73-60(16), by L. M. Berry, L. K. Jones, and D. E. Fjelseth.

Electrical contacts with low resistance are discussed relative to non-radioactive contamination, decontamination, fabrication, materials applications, wear, and lubrication. (C.J.G.)

24267 TID-6119
Oak Ridge National Lab., Tenn. and Office of Technical Information Extension, AEC.
LOW NOISE AMPLIFIERS FOR USE WITH SOLID STATE DETECTORS. Aug. 1960. 34p. OTS.

Data developed on low-noise amplifiers used with solid-state detectors are summarized. (W.L.H.)

24268 TID-6259
Bendix Aviation Corp., Kansas City, Mo.
PRODUCTION OF A RELAY UNDER CONTROLLED CONDITIONS. K. V. Newton. 1959? 27p. Contract AT(29-1)-613. OTS.

The manufacture of a high-voltage hermetically sealed relay is described. The relay has a contact resistance of the order of 0.005 ohm when measured at 6-volt d-c potential with 100 ma flowing through the contacts. The steps and processes to be followed in preparing the magnetic materials, the cleaning, and the assembly are specified. (W.D.M.)

24269 TID-6381
Picker X-Ray Corp. Waite Mfg. Div., Inc., Cleveland.
A SMALL FOCAL-SPOT X-RAY GENERATOR USING BETA-RAYS. Annual Report Covering a Period from June 1, 1959 to May 31, 1960. Research Report No. 60R16. M. W. Chisholm, R. J. Lambert, J. Parks, and Jacob Kastner. 38p. Project No. EXR-514. Contract AT(11-1)-746. OTS.

A literature search on focusing methods led to the design and construction of a magnetic quadrupole-lens system. A qualitative preliminary investigation with a small β-ray source showed strong evidence of focusing; however, the efficiency achieved was not established. A current-carrying wire analog was employed to determine the parameters of the quadrupole system preliminary to designing the permanent magnets and to determine the optimum achromatic configuration. (auth)

24270 TID-6393
Case Inst. of Tech., Cleveland.
SOLID STATE PHYSICS PROGRAM. CONSTRUCTION OF EQUIPMENT FOR MEASURING THE DE HAAS–VAN ALPHEN EFFECT. Technical Report No. 10. Alfred S. Joseph. June 1960. 25p. OTS.

A metal Dewar and a null deflection balance for automatic recording of the de Haas-van Alphen oscillations in the diamagnetic susceptibility of metals are described. Results of a preliminary study of a single-crystal magnesium specimen are included to illustrate the advantages of this technique. (auth)

24271 UCRL-5898
California. Univ., Livermore. Lawrence Radiation Lab.
A MONTE CARLO METHOD FOR DETERMINING THE EFFICIENCY OF A SPHERICAL "DISH" ARRANGEMENT OF NEUTRON DETECTORS. Joseph Fleck, Jr. Feb. 26, 1960. 21p. Contract W-7405-eng-48. OTS.

A Monte Carlo Method is described for calculating the amount of light emitted from a spherical dish array of scintillation detectors to be used in neutron angular correlation experiments. The dish is made up of a system of individual counters, and the method enables the determination of the average amount of energy deposited in a specific counter lying in the original neutron direction as well as the amount of energy deposited in other counters as the result of scattering out of the original counter. The collision processes taken into account assume that neutron energy to be 15 Mev or less. (auth)

24272 WADD-TR-60-98
Airborne Instruments Lab. Div. of Cutler-Hammer, Inc., Deer Park, N. J.
MICROWAVE GAMMA-RAY ION CHAMBER. Period covered: May 1958 through November 1959. Donald A. Brown, Karl C. Speh, and Jesse J. Taub Dec. 1959. 67p. Project No. 7360. Contract AF33(616)-5758. OTS.

A microwave γ ion chamber (and its associated equipment), which is capable of measuring gamma radiation in the range from 10^6 to 10^{10} erg/g-hr (carbon) was developed. This equipment operates at a microwave frequency of about 9kmc and measures radiation by using the changes in the reflection coefficient looking into a gas-filled microwave resonant cavity caused by ionization of the gas owing to radiation. Data on gas conductivity and resonant frequency shift were taken for different gas mixtures. (auth)

24273 CEA-tr-R-802
APPAREIL POUR LES MESURES DES PARAMÈTRES DES PHOTOMULTIPLICATEURS. (Apparatus for Measurement of Photomultiplier Parameters). A. A. Sanin (Sanine) and N. N. Dmitrieva. Translated into French from Pribory i Tekh. Ekspt. No. 2, 103-5(1957). 8p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 8573.

24274 CEA-tr-R-860
SÉLECTEUR EN TEMPS. (Pulse Analyzer). V. V. Okorokov. Translated into French from Pribory i Tekh. Ekspt. No. 6, 63-7(1958). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 5537.

24275 JPRS-5024(p.115-53)
THE SET-UP FOR TESTING THE RELAXATION OF STRESSES AT ELONGATION. V. S. Averki'ev (Averkiyev), G. N. Kolesnikov, A. I. Moiseev (Moiseyev), and M. V. Yakutovich. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 71-(?) (1958).

Design and operation of an apparatus for testing relaxation of elongation stresses are described. An analysis of testing measurement errors is included. (J.R.D.)

24276
MINIATURE SEMICONDUCTOR DOSE RATE METER. Carl Hellmuth Hertz and Rolf Gremmelmaier (Univ. of Lund, Sweden and Siemens Schuckert Werke, Erlangen, Ger.). Acta Radiol. 54, 69-80(1960) July. (In English)

A small dose-rate meter has been constructed for measurements inside body cavities using the photoeffect in a p-n-junction of a GaAs semiconductor. Because of the special geometry of the probe element, its energy-dependence in the conventional roentgen therapy range is reduced and shown to be quite satisfactory inside a water phantom. The length of the cylindrical probe is 10 to 25 mm; its diameter is 2.5 mm; and its sensitivity is about 3×10^{-9} A per r/min. (auth)

24277
SCINTILLATION SPECTROMETER WITH SUMMATION OF PULSES FROM TWO CRYSTALS. Josef Kajfosz and Jiri Kopecky (Inst. of Nuclear Physics, Prague). Československ. casopis pro fysiku 8, 574-82(1958). (Translated from Referat. Zhur. Fiz. No. 1, 1960, abstract No. 281).

A two-crystal scintillation spectrometer, based on the principle of summation of amplitudes of pulses from two detectors is described. A γ quantum which experiences Compton scattering in one crystal, falls into a second crystal, placed in line with the first one, and is absorbed there because of the photoeffect. With the aid of a coincidence circuit, the pulses corresponding to simultaneous registration of the γ quantum in both crystals are selected. The amplitude of the summary pulse is proportional to the energy of the primary radiation. The use of such a spectrometer makes it possible, through reducing the background owing to Compton scattering, to measure spectra with a large number of γ transitions. An effect analogous to the addition of pulses in Compton scattering of γ quanta is observed in pair production when one or both annihilation quanta leave the first crystal and are absorbed in the second. The efficiency of the spectrometer is measured for two values of the γ-quantum energy: at $E_\gamma = 0.661$ Mev, n = 3.3% (resolution 12.3%) and at $E_\gamma = 1.225$ Mev, n = 1.8%. The most convenient geometric placement of the crystals, ensuring the maximum effectiveness of the spectrometer, is discussed.

24278

ON THE SENSITIVITY AND REGRESSION OF SILVER BROMIDE IN IODIDE NUCLEAR EMULSIONS. Josef Kubal, Jaroslav Benes, and Zbynek Hrkal (Charles Univ., Prague). Českoslov. casopis pro fysiku 9, No. 2, 133-40 (1959). (Translated from Referat. Zhur. Fiz. No. 1, 1960, abstract No. 2430).

An investigation was made of the effective addition of silver iodide (0 to 8 M %) on the sensitivity (S) of nuclear silver bromide photoemulsions containing $CdBr_2$ to improve the homogeneity of the microcrystals by dimension. The emulsions were exposed to light and particles (α from Po^{210} and β from C^{14}). Adding up to 3% AgI reduces S relative to the light and α particles. Further increase of the concentration of silver bromide first reduces S to light, but after 5.5% it again increases it. With respect to β particles, the value of S is constant up to 3% silver bromide; it then drops and again remains constant after 5.5%. In individual traces of particles at a concentration of silver bromide above 4% there is noted an increase in grain size with the corresponding deterioration of the discrimination. A sensitization by 2-paradimethyl aminostyril benzothiazols (I) increases S (more to light than to particles), but does not influence the character of the dependence of S on the concentration of silver bromide. Also studied was the speed of regression at the same emulsions at temperatures 4 and 18°C. After sensitization with I, the regression increases for the action of light and decreases for the action of particles; this law is independent of the presence of silver bromide in the emulsion. To explain this law it is proposed that I acts only on the surface development centers, the number of sites of which are different for light and for particles. The rate of regression in AgBr + AgI emulsions is less than in pure silver bromide emulsions, and under the action of α particles it is substantially less than under the action of electrons. Hypersensitization with triethanol amine after sensitization with I increases S considerably to electrons: a low sensitive nuclear emulsion acquires ability of registering individual tracks of β particles from C^{14}, and when estimated by a blackening density of 0.6 over fog, S increases by a factor of more than ten.

24279

THE MEASUREMENT OF $^{14}CO_2$ ACTIVITY INSIDE GEIGER-MÜLLER COUNTING TUBES. R. Tykva (Inst. of Chemistry, Czechoslovak Academy of Science, Prague). Collection Czechoslov. Chem. Communs. 25, 1874-82(1960) July. (In English)

A method is described for the measurement of the relative activity of C^{14} as carbon dioxide in GM internal gas counting tubes, either with a mixture of argon and ethylene or with ethylene alone. The equipment permits reproducible measurements of a relative specific acitivity of carbon dioxide with a maximum total error of less than ±1.8% with a standard deviation of counting less than ±0.5%. (auth)

24280

CRYSTAL COUNTERS MADE OF CADMIUM SULFIDE WITH HIGH FREQUENCY ELECTRIC FIELD. Compt. rend. acad. bulgare sci. 11, No. 3, 169-72(1958). (Translated from Referat. Zhur. Fiz. No. 1, 1960, abstract No. 291).

A method is proposed for eliminating the polarization phenomena in a crystal counter by using a high-frequency voltage of approximately 1 Mc. The method is based on the high sensitivity of a vacuum tube high-frequency generator to losses in its tank circuit; a single crystal of cadmium sulfide 0.1-mm thick is connected in parallel with the tank circuit of the oscillator. The passage of an α particle through the single crystal leads to an instantaneous increase in the tank-circuit losses, which in turn leads to a change in the plate current of the oscillator tube. The magnitude of the pulse owing to the passage of the single α particle amounts to approximately 0.1 volt, and the pulse duration is several milliseconds. No changes were observed in the sensitivity of the crystals after prolonged operation. The method makes it possible to use cadmium sulfide crystals for α spectroscopy. The α spectra obtained for ThC and ThC′ are given.

24281

ETL ELECTROMAGNETIC ISOTOPE SEPARATOR. I. Kono. Denki Shikensho Ihô 24, 519-27(1960). (In Japanese)

A 60° sector type electromagnetic separator is described in which the ion beam lies in the horizontal plane and has a 70-cm radius of curvature. The magnet produces a maximum flux of 6000 gauss and the maximum accelerating voltage is 50 kv. The receiver is 3.15m long and is evacuated by 10 and 4 in. diffusion pumps. The apparatus was tested with Argon and Neon gases. As the result, more than 1 ma of collector current and a resolving power of about 200 were gained. After the test operation, the apparatus was successfully operated for 3 hr at a collector current of 2 ma with magnesium and sulfur. A few mg of both isotopes were collected. A detailed description of the apparatus and a preliminary experiment with argon, sulfur, and magnesium are given. (auth)

24282

MEASURING RADIOACTIVITY AROUND A REACTOR. L. Argiero, S. Manfredini, and S. Palmas. Ing. nucleare 3, 3-10(1960) Jan.-Feb. (In Italian)

A description is given of the collection and measurement equipment at the San Piero a Grado center for controlling ambient radioactivity inside a radius of about 30 km from the center itself. Measurements are planned of radioactive concentration in the air, dry and wet fall-out, radioactivity in the waters of canals and rivers in the area, and sources of irrigation and drinking water. The testing and sampling stations for measuring radioactivity in the air and fall-out were established by means of a surface wind frequency map of the area. The water of the Arno river was analyzed, taking into consideration the effect of tidewater backup (the center is some 4 km from the mouth of the Arno). The radioactivity levels measured in all types of water and in the fall-out from March to October of 1958 are reported. Periodical sampling techniques for testing fall-out and the techniques used for preparing samples for measurement are described. (auth)

24283

HIGH RESOLVING POWER MAGNETIC γ SPECTROMETER. L. V. Groshev, A. M. Demidov, V. N. Lutsenko, and A. F. Malov. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 791-801 (1960) July. (In Russian)

Descriptions are given of the design and performance of a Compton spectrometer capable of measuring the γ spectra from radioactive neutron capture at 0.3 to 12 Mev with a resolving power of 3% as $h\nu > 2$ Mev. At smaller energies the resolving power is not as high but is higher than for the older types of spectrometers. (R.V.J.)

24284

DOUBLE FOCUSING MAGNETIC SPECTROMETER. A. S. Deĭnenko, A. I. Popov, P. V. Sorokin, and A. Ya. Taranov (Khar'kov Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 924-8(1960) July. (In Russian)

A design is presented of a double-focusing spectrometer which utilizes a divided magnetic field with plane edges. The spectrometer was designed for recording nuclear reactions produced by an electrostatic accelerator. The vertical angle of the device is $\Omega = 4 \times 10^{-3}$ steradian. The entrance angle a in a plane perpendicular to the field is 5°7′; the resolving power is ~0.1%. (R.V.J.)

24285

ON THE CONSTRUCTION AND LONG-TERM PERFORMANCE OF MEDIUM PRESSURE BF_3 PROPORTIONAL COUNTERS USED FOR COSMIC-RAY RECORDING. P. H. Stoker (Potchefstroom Univ. for Christian Higher Education, South Africa). Nuclear Instr. & Methods 8, 23-6 (1960) July. (In English)

Construction and filling procedure of BF_3 proportional counters for a cosmic-ray neutron monitor are outlined. The method of improvement of the operational characteristics of the counters, necessitated by deterioration over the first years of continuous operation, is given. (auth)

24286

APPARATUS AND LABORATORY FOR PROCESSING NUCLEAR EMULSION STACKS. H. Engelhardt, I. Hauser, and U. Krecker (Deutsche Akademie der Wissenschaften, Berlin). Nuclear Instr. & Methods 8, 55-60(1960) July. (In English)

An apparatus is described for processing nuclear emulsion stacks with an area up to 35×45 cm^2. The apparatus is so constructed that 3.5 liters of emulsion with a thickness of 400 μ can be processed during 5 days. The procedure for developing nuclear emulsions of type NIKFI R is represented. (auth)

24287

OPTIMUM CONDITIONS FOR DOUBLE FOCUSING BETA RAY SPECTROMETERS. Mitsuo Sakai (Tokyo Univ.). Nuclear Instr. & Methods 8, 61-9(1960) July. (In English)

Formulas for the optimum dimensions of the source and the solid angle for the double-focusing spectrometer, including the sector-type spectrometer, were given in function of the given resolution. The maximum luminosities derived by these formulas were compared with each other. It was found that the sector-type double-focusing spectrometer, of which the field parameters α and β are equal to $^1/_2$ and $^1/_4$, respectively, has a configuration with very good focusing properties. It has, in the sense of the generalized Barber's law, such a configuration that the deflection angle is $^2/_3\pi$ and the distance between the image and the exit boundary of magnetic field is equal to the reference radius. The results were also compared with the ordinary semicircular spectrometer, the Konopinski-type semicircular spectrometer and the solenoid-lens-type spectrometer. These kinds of spectrometer have a nearly equal maximum luminosity, about ten times smaller than that of any type of double-focusing spectrometer. (auth)

24288

CIRCUIT LENGTHENER OF RAPID PULSES. A. Sarazin, J. Samueli, G. Ducros, and P. Raimbault (Institut d'Etudes Nucléaires, Algiers). Nuclear Instr. & Methods 8, 70-2 (1960) July. (In French)

A pulse lengthener that is meant to be used together with a multichannel analyzer in order to study the amplitude of pulses in the nanosecond range is described. The circuit is linear from 0.3 to 14 volts and its recovery time is 0.5 μsec. (auth)

24289

THE EFFECT OF GAMMA-BACKGROUND ON THE BF_3 PROPORTIONAL COUNTER. J. Csikai and M. Buczkó (ATOMKI, Debrecen, Hungary). Nuclear Instr. & Methods 8, 73-5(1960) July. (In English)

The integral amplitude distribution of the BF_3 proportional counter was found to be changed by the effect of a strong γ background. In the function of electronic amplification, the distortion of amplitude distribution was investigated with counters of different cathodes. The distortion of amplitude distribution due to the effect of γ radiation may be explained by the positive space charge developing around the anode. (auth)

24290

ON THE DETERMINATION OF RANDOM COINCIDENCES IN FAST-SLOW-COINCIDENCE-RATES. T. Mayer-Kuckuk (Max Planck Institut für Kernphysik, Heidelberg, Ger.) and R. Nierhaus. Nuclear Instr. & Methods 8, 76-8(1960) July. (In German)

In some applications of fast-slow coincidence circuits, the random-coincidence rate is not small compared with the true-coincidence rate. In such cases it is usually necessary to correct for random coincidences. The random-coincidence rate is considered as consisting of four parts (the first part corresponding to three randomly coincident pulses at the inputs of the slow triple coincidence circuit, and the other parts corresponding to the three possibilities of true coincidences between two pulses at two inputs randomly coincident with a pulse on the third input of the slow circuit). The four parts can be determined separately either by calculations using measured coincidence resolving times or by counting with delay lines before the inputs of the slow-coincidence circuit. The determination of random coincidences by using only a delaying cable before one input of the fast-coincidence circuit does not appear appropriate. (auth)

24291

NONLINEAR OPERATIONS ON PULSES BY MEANS OF p-n JUNCTIONS. G. Giannelli and L. Stanchi (Centro Studi Nucleari, Ispra, Italy). Nuclear Instr. & Methods 8, 79-91 (1960) July. (In English)

Some researches on the voltage-current characteristics of p-n junctions are described. It was found that by means of a suitable method of using a transistor, its emitter-base junction shows a characteristic that approximates the theoretical one much better than diodes do. In particular some types of transistors have been found whose i_E, v_{EB} characteristic is strictly logarithmic over more than five decades of current, whereas selected samples attain six decades. The use of such junctions for multiplying or dividing between them two or more pulses is described and the various problems arising in such applications and in more general ones, as exponentials, are analyzed. (auth)

24292

HEAVY PARTICLE DETECTOR WITH SILICON n-p JUNCTIONS. G. Amsel, P. Baruch, and O. Smulkowski (Ecole Normale Supérieure, Paris). Nuclear Instr. & Methods 8, 92-105(1960) July. (In French)

Silicon n-p junctions were used to detect heavy charged particles produced by nuclear reactions inside the accelerator vacuum chamber at room temperature. The response to particle energy dissipated in the barrier is linear. The width of resolved peaks at half maximum is independent of incident particle energy and is equivalent to 40 kev for α particles and 30 kev for protons and deuterons. The rise time of the signal due to particles stopped in the barrier is of the order of 1 millimicrosecond whereas that due to particles traversing it has a slow component; this allows their distinction electronically. The detectors are insensitive to γ rays and neutrons. (auth)

24293

RESPONSE OF SEMICONDUCTOR SURFACE-BARRIER COUNTERS TO NITROGEN IONS AND ALPHA PARTICLES. M. L. Halbert and J. L. Blankenship (Oak Ridge National Lab., Tenn.). Nuclear Instr. & Methods 8, 106-16(1960) July. (In English)

Silicon and germanium surface-barrier counters for detection of short-range ionizing particles were constructed and tested. Measurements with artificial pulses showed that the barrier height V_0 is about 0.6 volt in silicon and that with variation of the applied bias V, the barrier capacity is linear with $(V_0 + V)^{-1/2}$ as is expected from the Schottky exhaustion-layer theory. Measurements with natural α particles showed that the charge-collection efficiency is probably 100%, the energy loss per electron-hole pair is 3.50 ± 0.05 ev in silicon and 2.83 ± 0.03 ev in germanium, and the pulse-height resolution is outstandingly good. Two independent measurements with cyclotron-produced N^{14} ions up to 25 Mev showed that the pulse-height response is linear with energy. The ratio of N^{14} to α pulse height is equal to the energy ratio to within 1%. The response to a continuous energy distribution of α particles indicates that the sensitive depth is on the order of 20 μ greater than the barrier depth calculated from the Schottky theory. The excess sensitive depth probably represents diffusion into the exhaustion layer of holes produced below it. (auth)

24294

DISCUSSION OF AN IMPROVED RESOLUTION MAGNETIC COMPTON SPECTROMETER WITH SUPPLEMENTARY ELECTRIC FIELD. Gerhard Gilbert (Universität, Marburg, Ger.). Sitzber. Ges. Beförder. ges. Naturw. Marburg 81, 33-58(1959). (In German)

The equations of motion for Compton electrons in rotationally symmetric magnetic fields were set up and path equations up to the second order were calculated. Deviations based on energy-angular distribution of Compton electrons appear first in the second order. The two-directional focusing, well-known for homogeneous electrons, can thus be assumed for Compton electrons. It is shown that, in opposition to the wide-angle focusing possible in the case of homogeneous electrons, in the case of Compton electrons a wide-angle focusing is possible only for one primary gamma energy (the focusing energy). The possibility of correction of the focusing error using supplementary electric fields is pointed out, and a process is given for calculation of these fields. This is applicable if these fields are treated as electric double layers whose electric properties should be sufficiently characterized by their electron-optical refractive index. As an example, the correction of the focusing error for primary gamma energies between 2 and 3 Mev is calculated, and the corrected form of the electric double layer is given. For preparation of the field-producing electrodes, the application of net electrodes is recommended. The output of instruments corrected this way is discussed using a numerical example and compared with other instruments. An estimate shows that for comparable light intensities, a corrected instrument can achieve an improvement in resolution of 3 times or up to about 1%. (tr-auth)

24295

OBSERVATION OF CHARGED RELATIVISTIC PARTICLES IN A LUMINESCENT CHAMBER. B. A. Demidov and S. D. Fanchenko. Zhur. Ekspt'. i Teoret. Fiz. 39, 64-6(1960) July. (In Russian)

Luminescent chamber photographs of cosmic μ-meson tracks were obtained which indicate an ionizing power approaching the minimal value. The density of these tracks was measured. (auth)

24296

NEUTRON DETECTION. W. D. Allen. New York, Philosophical Library, Inc., 1960. 266p. $10.00.

The book is intended for those engineers and scientists who require a fairly detailed knowledge of neutron detection methods. A certain amount of background knowledge of nuclear physics and particle detectors is assumed. Topics covered include reactions, instruments, applications, and standards. (W.D.M.)

24297

DETEKCJA PROMIENIOWANIA JĄDROWEGO. (Detection of Nuclear Radiation). Jerry M. Massalski. Warsaw, Panstwowe Wydawnictwo Naukowe, 1959. 372p.

Chapters are included on interaction of radiation with matter; principles of operation of ionization detectors; the mechanisms of formation of electrical pulses and pulse shaping; ionization chambers; proportional counters; Geiger-Müller counters; scintillation counters; determination of statistical errors; statistical analysis of counting arrangements; scaler circuits; integrating circuits; circuits, coincidence and anti-coincidence; and pulse-height analyzers. (TTT)

24298

INSTRUMENTATION FOR NUCLEONICS. A. H. Emmons (Univ. of Michigan, Ann Arbor). p.11-20 of "Symposium on Radioisotopes in Metals Analysis and Testing. Presented at the Sixty-second Annual Meeting, Atlantic City, N. J., 1959. ASTM Special Technical Publication No. 261." Philadelphia, American Society for Testing Materials, 1960.

An outline is given of the criteria that are usefully applied to the selection of the proper instrumentation to perform a particular analysis. Various types of instruments are described which are utilized in the detection of α, β, and γ radiations. The counters described include end-window Geiger counters, gas-flow proportional counters, and well scintillation counters. Some data are included on license-free isotopes; these include half life, type of radiation, cost, counting technique, and dilution volume at which the isotope is detectable. (B.O.G.)

24299

International Atomic Energy Agency, Vienna.
METROLOGY OF RADIONUCLIDES. PROCEEDINGS OF A SYMPOSIUM, VIENNA, 14-16 OCTOBER, 1959. 1960. 479p. $5.00.

Thirty eight papers are included. These papers represent a general survey of routine methods of standardization of radionuclides and new absolute measuring methods for standardization. Separate abstracts were prepared for thirty-seven papers; one paper was previously abstracted in NSA. (M.C.G.)

24300
ROUTINE METHODS OF STANDARDIZATION IN CANADA. PART I. P. J. Campion (Atomic Energy of Canada, Ltd., Chalk River, Ont.). PART II. K. W. Geiger (National Research Council of Canada, Ottawa). p.3-20 of "Metrology of Radionuclides." (In English)

The standardization of β-active nuclides was undertaken by using the 4 π β and 4 π β-γ coincidence techniques. The detectors used were gas-flow counters operated in the proportional region. For gaseous activities the method of differential gas counting is employed while for those nuclides which decay by electron capture a high pressure 4 π proportional counter is available. Radium standardization, by ionization measurement, is carried out at the National Research Council, Ottawa. The ionization chamber and associated circuitry are described. An accuracy for intercomparison of sources of 0.1% can be achieved. The same ionization chamber can also be used to calibrate Co^{60} sources in the millicurie range. The radium and cobalt sources calibrated routinely are mainly for medical application. Standardization of other nuclides is carried out by determining their specific γ emission. The absolute calibration of neutron sources is also undertaken using various methods, whereas intercomparison of neutron sources is effected by long BF_3 counters. Recently, a 4 π β-γ coincidence apparatus was built which basically followed the design used by Atomic Energy of Canada Limited. (auth)

24301
CALIBRATION OF RADIONUCLIDES IN FRANCE. B. Grinberg (Centre d'Etudes Nucléaires, Saclay, France). p.21-31 of "Metrology of Radionuclides." (In French)

The French laboratories for the measurement of radioactivity are described. Allocation of work, activities, equipment, staff, and future prospects are discussed. Calibration of radionuclides using standard solutions and solid sources is discussed. Methods of preparation, comparisons with corresponding laboratories in other countries, and supply statistics are given. (auth)

24302
STANDARDIZATION OF RADIONUCLIDES IN THE ELECTROTECHNICAL LABORATORY, TOKYO. Masashi Naito, Yajiro Inouye, and Osamu Yura (Electrotechnical Lab., Tokyo). p.33-40 of "Metrology of Radionuclides." (In English)

Since 1953, the Electrotechnical Laboratory has undertaken absolute measurements of the activities of some radionuclides by means of the 4 π β counting method and the coincidence method. In the 4 π β counting method, a bell-type gas-proportional counting apparatus was designed, and its counting characteristics were investigated, especially the dependence upon the counting gases. In measuring the activity, about 50 mg of the sample was taken on a thin film and then dried in the silica gel desiccator. One drop of a wetting solution was added on the dried sample so as to reduce the self-absorption, and the sample was dried again. The thin film was prepared by spreading a synthetic resin (Kanevinyl-R1108 in cyclohexanon) over the water surface, taking it up on the metal ring, and then covering with very thin gold by means of the vacuum evaporating method. Sr^{90}-Y^{90}, Co^{60}, and Cs^{137} were measured by the above procedure. The accuracies of the measurements were about ±2%. In the 2 π α counting method, the samples, RaD + E + F, U^{238}, and Po^{210} were measured by means of the same apparatus as in the 4 π β counting method. The accuracies of the measurements were ±2, ±1, and ±1%, respectively. In the coincidence method, both β -γ and γ-γ counting methods were employed. A scintillation counter of Tl activated NaI was used as a γ detector, and a GM counter as a β detector. Recently, in order to examine the inherent difference between the 4 π β counting and the coincidence counting methods, instead of the GM counter, a special type of the 4 π β proportional counter was devised which can also be used as 4 π β proportional counting apparatus apart from the coincidence circuits. The results obtained from the β-γ coincidence method were, in general, somewhat different (3 to 4%) from those of the 4 π β counting method. This may be due to self-absorption. On the other hand, the result for Co^{60} obtained by γ-γ coincidence was in agreement with that from β-γ coincidence counting. (auth)

24303
ROUTINE STANDARDIZATION OF RADIONUCLIDES IN THE UK. B. M. W. Robinson (National Physical Lab., Teddington, Eng.). p.41-51 of "Metrology of Radionuclides." (In English)

Standards of radionuclides, whose activities were measured either directly by a primary method or by comparison with a primary standard, are available. Some estimates of the staff employed and of standards issued are given. An advisory committee has promoted the interchange of information and measurements. For routine issues, the National Physical Laboratory (NPL) uses 4 π β counting in its various forms, linked with coincidence counting and reference ionization chamber methods. To deal with a wider variety of nuclides, AERE uses gas and scintillation counting for special purposes. The apparatus employed is described. The internal consistency and agreement with the results of other laboratories are discussed for a number of the more important nuclides. A combined β-γ reference ionization chamber was designed and is now commercially available. Many of these chambers were calibrated at NPL, and their performance and consistency are discussed. (auth)

24304
ABSOLUTE MEASUREMENT OF RADIOACTIVE MATERIALS AT THE PHYSIKALISCH-TECHNISCHE BUNDESANSTALT. H. M. Weiss (Physikalisch-Technische Bundesanstalt, Brunswick). p.53-60 of "Metrology of Radionuclides." (In English)

Routine methods for the standardization of radionuclides are given. The measurements are made by 4 π β proportional counters, 4 π β-γ coincidence counting, and for secondary standardization of γ emitters by a 4 π γ ionization chamber. The equipment used and the procedures for source preparation are described. (auth)

24305
RADIOACTIVE METROLOGY METHODS IN THE USSR. K. K. Aglintsev (Inst. of Metrology, Leningrad), V. V. Bochkarev, V. N. Grablevskiĭ, and F. M. Karavaev. p.61-88 of "Metrology of Radionuclides." (In Russian and English)

The methods practiced in the USSR and in particular at the Mendeleev Institute of Metrology at Leningrad for the reproduction, by means of standardized apparatus, of the units of measurement used for radioactivity (curie, gram-equivalent of radium, roentgen, and rad) are reviewed. The standard sources regularly produced in the USSR are of two types. Model sources are used in standardizing other radioactive substances by comparison and in calibrating radiometric and monitoring instruments. Control sources are used exclusively for checking the functioning of measuring instruments and the reproducibility of the data yielded by them. Model α sources are prepared by electrolytically depositing suitable selected emitters (natural U, U^{233}, Pu^{239}, and Am^{241}) on platinum. Activities over the range 30 to 10^6 disintegrations per minute can be provided. The control α sources consist of an electrolytic deposit of Pu^{239} in a layer with a specific weight of between 3×10^{-9} and 0.7 mg/cm^2, corresponding to activities of 10 to 10^8 disintegrations per minute. Model β sources are made of radionuclides selected so as to provide a range of maximum energies of 0.018 to 2.3 Mev. Control β sources are prepared from either $Sr^{90} + Y^{90}$, Tl^{204}, or Pm^{147}. These sources cover a wide range of activities of between 20 and 10^9 disintegrations per minute. Model γ sources are made of either radium, Co^{60}, or Cs^{137}. The range of activities covered by these standards falls between the orders of magnitude of 10^{-11} and 5 gram-equivalents of radium. The control γ sources are based on the same radionuclides. Their activities cover a very wide range and they vary considerably in form and size. The model neutron sources are of two types. These are Ra-α-Be (containing 1 to 1000 mg Ra) and Pu-α-Be (containing 0.01 to 15 g Pu). The Ra-α-Be sources consist of a compressed mixture of $RaBr_2$ and powdered beryllium with a Ra/Be ratio of 1:6 by weight. The Pu-α-Be sources consist of an alloy ($PuBe_{13}$) of these two metals. (auth)

24306

ROUTINE METHODS OF RADIOACTIVITY STANDARDIZATION AT THE NATIONAL BUREAU OF STANDARDS (USA). W. B. Mann (National Bureau of Standards, Washington, D. C.). p.89-102 of "Metrology of Radionuclides." (In English)

Routine methods for the measurement and maintenance of radioactivity standards at the National Bureau of Standards are reviewed. (auth)

24307

TECHNIQUES OF LARGE SCALE PROCESSING OF COUNTING DATA. G. G. Manov and D. L. Eads (Tracerlab, Inc., Richmond, Calif.). p.103-15 of "Metrology of Radionuclides." (In English)

The problems of a laboratory performing over 10,000 radionuclide analyses per year, each of which requires a high degree of accuracy, but below that required in absolute standardization, call for special requirements in data handling and in data processing. Typical measurements involve mixtures of α emitters and multichannel pulse-height analyses, 2 π and 4 π β counting, and β-γ coincidence measurements. Efficient use of instruments for measuring low levels of activity is achieved by the technique of multiplexing with magnetic tape storage and read-out. Arithmetical errors, particularly the troublesome ones involving inadvertent transposition of digits, are virtually eliminated by the use of electronic calculators. In one typical operation involving a mixture of known nuclides, the gross counting data are fed into a machine which prints (reads-out) the answer on an electric typewriter. Alternatively, the results, if from a spectrometer, can be automatically plotted on an X-Y graph for further interpretive analysis. Block diagrams illustrating the sequence of steps are presented. Decay corrections are easily handled by discarding the concept of the Gregorian calendar and employing instead a year in which the days are numbered consecutively beginning at midnight of the night of 31 December—1 January, Greenwich Mean Time. For example, July 17, 1959, 3:5 PM Pacific Coast Daylight Saving Time is 198.920 days, and 2:30 PM October 16, 1959, Vienna time is 289.854. The advantages of being able to add, subtract, multiply, or divide times expressed in this manner is apparent. The electronic circuit of a time clock based on this principle is described together with photographs. (auth)

24308

THE ORGANIZATION OF INTERNATIONAL INTERCOMPARISONS OF RADIOACTIVITY STANDARDS, WITH SPECIAL REFERENCE TO SUCH MEASUREMENTS OF NBS STANDARDS. L. M. Cavallo and W. B. Mann (National Bureau of Standards, Washington, D. C.). p.117-22 of "Metrology of Radionuclides." (In English)

The need for, and organization of, international intercomparisons of radioactivity standards are discussed. The results of some recent measurements are reviewed. (auth)

24309

STANDARDIZATION OF RADIONUCLIDES AT THE ATOMIC ENERGY COMPANY (SWEDEN). Josef Braun (Aktiebolaget Atomenergi, Stockholm). p.123-32 of "Metrology of Radionuclides." (In English)

The equipment in use at the laboratory of the Atomic Energy Company, Sweden, for absolute measurement is described. A survey was made of the results of β standardization performed with 4 π and 2 π proportional counters. An apparatus used for absolute measurement of gaseous isotopes is described. (auth)

24310

A NEW DESIGN FOR A HIGH PRECISION, HIGH GEOMETRY α COUNTER. Herman P. Robinson (Univ. of California, Berkeley). p.147-54 of "Metrology of Radionuclides." (In English)

A relatively high geometry α chamber is described which permits precision measurements on α sources deposited on a packing plate. The acceptance angle was chosen so that back-scattered particles are excluded, and this limits the geometry to not more than approximately π steradians. A conventional counter configuration of such transmission would suffer in precision because of the large uncertainty in geometry caused by very small variations in axial position of the source. To overcome this defect a design is described in which a central axial stop is placed in such a manner that compensation is incorporated to reduce the effects on geometry of a lateral translation of the source or use of an extended source. (auth)

24311

DISINTEGRATION-RATE DETERMINATION BY 4 π COUNTING. Brian D. Pate (Washington Univ., St. Louis). p.163-74 of "Metrology of Radionuclides." (In English)

The history of the development of the 4 π counting method is reviewed. The unique properties of the 4 π counter system are described and the criteria are specified which place disintegration-rate measurements made with the system on an absolute basis. The types of radioactive decay process to which the method is applicable are outlined, together with the various errors to which a given measurement is liable. Departure of response probability from unity, absorption of radiation in the source-mounting system, and source self-absorption are discussed in detail. (auth)

24312

DEMOUNTABLE 4 π GEIGER COUNTERS FOR STANDARDIZATION AND THE ASSAY OF LOW-ACTIVITY SAMPLES. N. G. Trott, R. E. Bentley, and L. K. Burton (Royal Cancer Hospital, London). p.175-84 of "Metrology of Radionuclides." (In English)

Some developments in the design of 4 π GM counters are reported and applications of these counters in the measurements of radioactive standards in relation to radiological work are discussed. In the two types of 4 π GM counter described, the anode wires can be easily removed thereby facilitating cleaning. One type was used successfully for several years in the standardization of β-emitting nuclides and some results of intercomparisons of standards with other laboratories are presented. These counters were also applied, in conjunction with a γ ionization system, in determinations of the specific γ emission (k-factor) for Fe^{59}, Cs^{137}, and Ir^{192}. The second type is a smaller low-background version of the same counter, constructed in stainless steel and designed primarily for the assay of small amounts of radioactivity in biological materials. It can also be adapted for the absolute measurement of radioactive sources at low counting rates ($\leq$ 100 counts per minute) since, when shielded with cosmic ray counters in anticoincidence, a stable background of between 1 and 2 counts per minute can be obtained. (auth)

24313

ON ABSOLUTE MEASUREMENTS OF β-EMITTING RADIONUCLIDES. A. M. Baptista (Comissão de Estudos da Energia Nuclear, Lisbon). p.201-25 of "Metrology of Radionuclides." (In English)

Four π GM detectors are described and some of their characteristics presented. The absence of spurious pulses is shown by the measurement of the rate of arrival of intervals between pulses. Some problems related to the foil and source absorption are considered, and an experimental method for their correction by using paired sources is presented. The preparation of standards of Bi^{210} is described. A note is presented on the problem of foil absorption losses in scintillation absolute counting. (auth)

24314

REMARKS ON A RAPID METHOD FOR MEASUREMENT AND ANALYSIS OF β EMITTERS IN SOLUTIONS OF VERY LOW SPECIFIC ACTIVITY. Y. Le Gallic, B. Grinberg, and M. Thenard (Centre d'Études Nucléaires, Saclay, France). p.245-51 of "Metrology of Radionuclides." (In French)

A measuring instrument with a low-level background is described for measuring radioactive materials in liquid form. Essentially the instrument consists of two flat counters (each with one hole) and one flat counter with two holes. These are mounted parallel to each other and enclosed in a casing of counters mounted in anti-coincidence with the inner counter. Possible applications of the method include: measuring much lower-level specific activities than with liquid counters, and particularly soft β emitters; detecting radioactive impurities with a radionuclide (e.g., 2/10,000 of P^{32} in S^{35}); and measuring without previous concentration, specific activities corresponding to the tolerance limits permitted at present. (auth)

24315

LOW-LEVEL β AND γ COUNTING IN THE REGION 0–10 DISINTEGRATIONS PER MINUTE. George G. Manov (Tracerlab, Inc., Richmond, Calif.). p.253-68 of "Metrology of Radionuclides." (In English)

Measurements of levels of radioactivity in the region of 0 to 10 disintegrations per minute are becoming increasingly useful in the standardization of radionuclides as well as in other branches of science such as geology and medicine. For example, there is frequent need for low-level counting in the field of biological and tracer applications, particularly in those cases in which the use of a higher level of radiation would alter the course of the mechanism or process under study. Frequently such measurements must be made under conditions in which the sample possesses an activity of only 1% of the normal unshielded background radiation. At other times, an additional requirement is imposed because the radionuclide may have a very short half life. There are three general ways in which the reliability of low-level measurements can be increased. These are more efficient counters, smaller background corrections, and more stable, noise-free electronic systems. Comparative tests are described of the relative merits of three different types of guard (anti-coincidence) counters in reducing the background. Measurements were made of umbrella, annular, and scintillating plastic igloo. The increasing difficulty of obtaining activity-free materials for construction of counters is a matter of some concern. Data are presented for the range of activities of materials available commercially. Stockpiling of such materials, preferably of pre-War II origin is rapidly becoming a necessity. The stability of the electronic system is a prime requisite for low-level counting, particularly to avoid the counting of spurious pulses. A system is described in which a slow, measured rate of pulses is fed into the electronics, passed through the amplifier and deducted from the gross output of the register. In general, transistorized circuitry, including preamplifiers and power supplies, are more satisfactory than conventional vacuum-tube devices. (auth)

24316

THE COMPARATIVE ACCURACY OF THE 4 π LIQUID SCINTILLATION COUNTING METHOD OF RADIOISOTOPE STANDARDIZATION. J. Steyn (National Physical Research Lab., Pretoria). p.279-90 of "Metrology of Radionuclides." (In English)

The accuracy of the 4 π liquid scintillation counting method of standardizing β emitters was compared to 4 π β-γ coincidence counting for the nuclides Co^{60}, I^{131}, and Au^{198}. For P^{32} the liquid counting results were compared to 4 π proportional counting. The efficiency of the liquid scintillation counting method was found to be energy dependent, dropping to about 97.5% for Co^{60} which was the lowest energy β emitter investigated. (auth)

24317

MEASUREMENT OF β EMITTERS BY THE RADIATED CHARGE. J. J. Engelmann (Centre d'Études Nucléaires, Saclay, France). p.291-300 of "Metrology of Radionuclides." (In French)

The measurement of β emitters by the radiated charge is based on the principle recently described by Failla and his associates. Two plane electrodes of the same material are mounted parallel to, and close beside, each other in a vacuum container and the source which is to be measured is laid on one of them. The back-scattering on this electrode is offset by the reflections on the other electrode. A magnetic or electrical field makes it possible to eliminate the effect of low-energy secondary electrons. In the case of magnetic deflection, the apparatus includes an extrapolation chamber and, in the case of electrical deflection, a chamber with a very fine grill. In the case of Sr^{90}-Y^{90} and P^{32} the results obtained agree very well with the measurements made with the 4 π counter (better than ±2%). In the case of S^{35} the results seemed to be affected by the atomic number of the substance of which the electrode on which the source is placed consists. The theories on back-scattering provide an explanation of these results. (auth)

24318

THE ABSOLUTE MEASUREMENT OF THE RADIOACTIVITY OF GASES. K. Hogrebe (Kernreaktor Bau- und Betriebs-Gesellschaft, Karlsruhe, Ger.). p.301-5 of "Metrology of Radionuclides." (In English)

After a survey of the present state of development of methods for the absolute measurement of the activity (decay rate) of radioactive substances, the measurement of radioactivity in gases (internal gas counting) is treated in more detail. In particular, methods for finding and correcting mistakes that arise in this method of measuring are suggested. The absolute accuracy of measurements obtained by the isotope laboratory with the correction methods referred to is at present about 2%. It should be further improved in the near future. (auth)

24319

RECENT WORK WITH COMPENSATED INTERNAL GAS COUNTERS FOR THE STANDARDIZATION OF GASEOUS RADIONUCLIDES. W. B. Mann (National Bureau of Standards, Washington, D. C.). p.307-15 of "Metrology of Radionuclides." (In English)

The criteria for compensation in internal gas counters and recent applications of such counters at the National Bureau of Standards are reviewed. (auth)

24320

SOME METHODS OF MEASURING β-ACTIVE GASES. V. V. Bochkarev (Isotope Lab., Moscow) and V. A. Bazhenov. p.317-31 of "Metrology of Radionuclides." (In Russian and English)

A number of methods for the absolute measurements of β-active gases by means of special devices, in which gas discharge counters are used, and also some methods of relative and absolute measurements of the activities of readily volatile liquids are discussed. Formulas are given for calculating the theoretical counting rate of a cylindrical counter placed in a coaxial vessel, taking into account the specific activity of the filling gas and a device consisting of an end-window counter introduced into a cylindrical vessel. Methods for more accurately measuring β-active gases by means of the gas-flow counter, as well as the methods of relative and absolute measurements of the activity of some β-active liquids through their vapors, are described. (auth)

24321

ON THE SINGLE-SCINTILLATOR COINCIDENCE TECHNIQUE. R. V. Gasstrom (International Atomic Energy Agency, Vienna). p.333-5 of "Metrology of Radionuclides." (In English)

It is shown that in low-energy counting with single scintillators the coincidence technique can be improved by summing the pulses from the photomultipliers in coincidence. The use of semiconductor devices in the circuitry is advocated for simplicity and reliability. Further development in this technique concerns the scintillator and the photocathode. (auth)

24322

SOME REMARKS ON THE PROGRESS IN ELECTRON CAPTURE STANDARDIZATION. R. A. Allen (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.343-52 of "Metrology of Radionuclides." (In English)

A brief review is given of the measurement of low-Z, electron-capture nuclides using the 4 π x-γ coincidence method and a pressurized (up to 4 atm) 4 π proportional counter. A new steel 4 π proportional counter is described. This counter is designed to operate at pressures up to approximately 40 atm. Results on low-Z nuclides in this counter and in the lower pressure model are compared. The measurement of nuclides of higher Z is described. Samples were investigated by using the high-pressure counter for x-ray determination and by 4 π scintillation counting employing both NaI phosphors and plastic scintillators. An attempt was made to calibrate the samples with a liquid scintillation counter. A determination of the relative numbers of K and L x rays emitted is described together with a measurement of the number of K x rays accompanied by L x rays. Accurate determination of these quantities enables high-Z, electron-capture nuclides to be assayed by the relatively simple method of 4 π counting its L x rays. The measurement of Auger electrons from the high-Z nuclides in a conventional (low pressure) 4 π GM counter is also described. A short account of a redetermination of the electron-capture/β^+ branching ratio in Co^{58} is described. The method involves absolute β^+ counting and coincidence techniques. (auth)

24323

THE PROPORTIONAL COUNTER. SOME ASPECTS OF OPERATION. S. C. Curran (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.353-69 of "Metrology of Radionuclides." (In English)

Work on a counter system designed for electron-capture studies showed that the diameter of the anode wire in a high-pressure proportional counter can have an important influence on the energy resolution obtained in measurements of low-energy radiations. In a counter working at a pressure of 12 atm, the width of the pulse distribution due to 13.5 kev K-capture radiations could be changed from 65 to 17% by changing the wire diameter from 0.0076 to 0.0025 mm. This phenomenon was interpreted as an effect of positive-ion space charge in the avalanche. For a given gas gain and primary radiation, the density of positive ions in the avalanche increased rapidly with the pressure of the filling gas, and when the accompanying electric fields were large enough to affect the last stages of the multiplication process, the energy resolution of the counter deteriorated. Decrease in the diameter of the anode wire increased the externally applied field in the region where multiplication took place, thus tending to counteract the effect of space charge. Use of 0.0025 mm anode wires proved satisfactory in new measurements of L/K capture ratios made with a multiwire counter system working at pressures up to 12 atm. The results obtained for L/K capture ratios of Ge^{71} and Kr^{79} were 0.115 and 0.112, respectively. The same counting system was also used in a search for M capture in these two isotopes. The low energy of the M capture radiation, 180 ev in Ge^{71} and 260 ev in Kr^{79}, and its low intensity relative to that of K capture make accurate measurement difficult; but peaks attributable to M capture were observed in pulse spectra of both sources. Recent observations made on a combination of proportional and scintillation counters (operating as shields) showed that there were some real difficulties in devising a relatively simple system of this kind. The performance was very satisfactory, but practical matters such as long-term gas purity were difficult to overcome. An approach to systematic observations in gases and mixtures of moment in proportional counting is described. It is hoped that such measurements as are effected with this arrangement will be valuable in enlarging the field of application of the counters. (auth)

24324

THE PROOF SENSITIVITY OF WELL-TYPE CRYSTALS OF DIFFERENT SIZES WITH REGARD TO QUANTUM RADIATION FROM COMMON RADIONUCLIDES. K. Waechter (Frieseke & Hoepfner G.m.b.H., Erlangen-Bruck, Ger.). p.375-84 of "Metrology of Radionuclides." (In English)

Published works contain theoretical details of proof sensitivity of NaI crystals and some experimental data on proof sensitivity of well-type crystals. In order to assess the usefulness of a well-type crystal for a specific measuring problem, it is not sufficient to state the sensitivity of the detector. Only consideration of further factors, such as the nil effect of the arrangement, the time required for measuring, and the degree of accuracy demanded, can help to decide whether the measuring problem in question is capable of solution. A method for dealing with this interrelationship is suggested. Although proof sensitivity is the main determining factor in deciding how far a problem can be solved, in calibrating radioactive sources, more significance is attached to the actual number of impulses per unit of activity observed by the equipment available. Fundamentally, this factor depends on the particular nature of the electronic series connection in the well-type crystal. For various combinations of equipment, the sensitivities are given as determined experimentally for some commonly-used isotopes. The detailed discussion of errors includes the investigation of count losses in well-type crystal measurements. In addition, the dispersal width of the defined sensitivity was investigated in various specimens of the same type of crystal. (auth)

24325

LOW LEVEL STANDARDIZATION PROGRAMME AT RISÖ. J. Thomas, P. Skjerk Christensen, Bant Fastrup, J. Olsen, and P. Villemoes (Atomenergikommissionen, Risø, Denmark). p.387-91 of "Metrology of Radionuclides." (In English)

In order to obtain a calibrated neutron flux, several methods were employed. A comparison is made of the results obtained by the different methods. (auth)

24326

ABSOLUTE β COUNTING AND ITS APPLICATION FOR THE STANDARDIZATION OF RADIOACTIVE NEUTRON SOURCES. K. W. Geiger (National Research Council of Canada, Ottawa). p.393-400 of "Metrology of Radionuclides." (In English)

The emission rate of the Canadian neutron standard, a Re-Be (α, n) source, was determined by two methods. Both involved the standardization of radioactive nuclides. By the first method the neutrons were moderated in a manganese sulfate solution surrounding the source. A calculable number of thermal neutrons was captured in the manganese of the bath, and it produced radioactive Mn^{56}. From its resulting activity the neutron-emission rate was found. High specific activity Mn^{56} solution, prepared by using the Szilard-Chalmers process, was standardized by 4 π β counting (proportional) and compared with the activated solution of the bath. The second method makes use of the F^{19} (α, n) Na^{22} reaction in a specially prepared Po-F source. Since fluorine is monoisotopic, the neutron output could be calculated from the yield of the resulting Na^{22} because for each neutron a Na^{22} nucleus was produced. Na^{22} is a positron emitter and discrimination against γ rays from Po^{210} and from the reaction could be achieved by detecting the two annihilation quanta in coincidence. Comparison was made with a standardized Na^{22} source. Standardization was carried out using the 4 π β-γ coincidence technique. Details on its application to Na^{22} are described. (auth)

24327

THE CONCEPT OF "GRAMME-EQUIVALENT-OF-RADIUM" FOR NON-POINT ISOTOPIC γ-RAY SOURCES. J. Domanus and B. Osuchowski (Nuclear Energy Commission, Warsaw). p.405-11 of "Metrology of Radionuclides." (In English)

There exists a difference of opinion as to the concept of the "gram-equivalent-of-radium." This occurs especially for γ sources of higher activities and dimensions when, owing to autoabsorption, the sources cannot be regarded as point-sources. According to one point of view, the concept of gRa is connected directly to the isotope itself. For any particular isotope, the gRa value from the ionization constant Kγ of the isotope can be determined. The other point of view attaches the gRa concept to any particular source of γ radiation. For a particular source, the gRa value is determined by measuring its dose-rate in r/h at a distance of 1 m. For γ sources of higher activities and dimensions the gRa values calculated by the two methods can differ considerably. Therefore, there is a need to clarify the opinions about the gRa concept in order to be able to formulate this radiologic unit definitively. It is also advisable to determine standard measuring methods of the gRa unit. Sometimes, instead of the c or gRa values, the "rhm" value (r/h at 1 m distance from the source) is given. This value, pertaining to the source itself, is equivalent to the second concept of gRa. However, it does not give immediate information regarding the activity of the source, which for many years was compared with radium standards. The use of the gRa unit for γ sources as it is used in industrial radiography and teletherapy is recommended. (auth)

24328

BATTERYLESS γ-RAY DOSIMETER. Bernhard Gross (National Inst. of Tech., Rio de Janeiro). p.413-17 of "Metrology of Radionuclides." (In English)

The Compton current produced by x and γ rays in the 0.3 to 3 Mev range is proportional to the radiant energy flux. Therefore, the intensity of the current can be used as a measure of radiation dose. The present paper describes a radiation receiver and an electrical-measuring system that is suitable for Compton current measurements and results obtained with this device under irradiation from a 2000 curie Co^{60} source. (auth)

24329

CALORIMETRIC MEASUREMENTS OF γ-RAYS AND CALIBRATION OF FERROUS SULPHATE RADIATION DOSIMETER. A. Brynjolfsson and N. W. Holm (Atomic Energy Research Establishment, Risø, Denmark). p.419-22 of "Metrology of Radionuclides." (In English)

An absolute determination of the high dose-rate in the 1200 curie Co^{60} facility of the Danish Atomic Energy Commission was performed by calorimetric methods. Experimental equipment and results are discussed. (auth)

24330

THE ADIABATIC MICROCALORIMETRY METHOD WITH AUTOMATIC COMPENSATION. APPLICATION TO COMPARISON OF Ra STANDARDS. M. Lecoin (Institut du Radium, Paris). p.429-35 of "Metrology of Radionuclides." (In French)

New automatic compensating adiabatic microcalorimetric equipment built at the Curie Laboratory of the Radium Institute is described. Potentialities and accuracy of microcalorimetric methods and their application to the comparison of radium standards are discussed. (auth)

24331

ON THE MECHANISM OF FATIGUE EFFECTS IN PHOTOMULTIPLIERS. G. Kainz (Österreichische Hochschule, Vienna), K. Schärf, and R. Patzelt. p.439-45 of "Metrology of Radionuclides." (In English)

New data on the fatigue effects in photomultipliers were collected. The conclusions appear to be valid for all tubes with cesium compounds present in the system. The fatigue effect takes place in all the dynodes and, very likely, also in the photocathode. The magnitude and time dependence of the instabilities vary with dynode current and ambient temperature. The recovery characteristics appear to depend mainly on the structure of the system. The theory given on the mechanism of the fatigue effect shows that the long-term instabilities are very likely caused by changes of the work function of the emissive layers. The extent to which the influence of the photomultiplier instabilities on calibrating methods can be taken into account is discussed. (auth)

24332

METHODS OF PARTICLE DETECTION IN FREE NEUTRON DECAY. T. B. Novey (Argonne National Lab., Ill.). p.449-58 of "Metrology of Radionuclides." (In English)

A number of experimental studies were recently completed on the decay of polarized neutrons in order to elucidate the structure of the weak nuclear interaction. These studies took the form of the measurement of the angular distributions of electrons and protons with respect to the spin direction of the decaying free neutrons. The basic components of the apparatus which are discussed are the one-meter iron-cobalt mirror that selects a beam of highly polarized neutrons and the methods for determination of the polarization; the electron detector comprising a 10-cm diameter, 6-mm-thick mosaic of anthracene crystals and its light pipe system; the proton detector, which is a 14-stage electron multiplier system (the first stage having a 15 × 15 cm opening and tapering in four stages to a standard 10-stage multiplier structure) and its entrance baffles for angular resolution; and the electronic system, which selects pulses from the detectors having the proper time sequence, relative time-delay, and pulse-height to allow indentification of a neutron decay. (auth)

24333

ESTIMATION OF A DISTRIBUTED β EMITTER BY MEASUREMENTS OF BREMSSTRAHLUNG. J. L. Putman (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.459-64 of "Metrology of Radionuclides." (In English)

In tracer experiments involving large, solid samples, the direct measurement of β particles is restricted to those which originate near the surface of a sample. The greater penetration of bremsstrahlung, produced when β particles are stopped in the body of the sample, allows contributions to be detected from a much larger volume. Ca^{45} was used to measure the transfer of calcium from refractory to metal in a steel furnace; cast ingots containing the tracer isotope were used for measurement. The Ca^{45} content of these ingots was estimated by comparison with a dummy ingot, which was built up to the same size and shape with laminated steel sheets. A thin lamina, carrying a measured quantity of Ca^{45}, was placed at various depths in the dummy ingot to obtain the counting rate (from bremsstrahlung) contributed by layers of the tracer at these depths, and the resulting curve of counting rate vs. depth was plotted. By integrating this curve, the total counting rate corresponding to a known uniform distribution of the tracer was deduced. The counting rates from sample ingots, measured under identical geometrical conditions, were then a good measure of their total calcium content. Calcium concentrations of a few ppm were determined by these means. (auth)

24334

IMPROVEMENTS RELATING TO ELECTRIC GENERATORS. John Warren Hibbert (to A. Reyrolle and Co., Ltd.). British Patent 836,976. June 9, 1960.

A self-excited a-c electric generator providing a low-frequency polyphase supply of variable frequency was invented for synchronous motors operating in either direction at variable speeds or standing at rest against a load torque for prolonged periods, such as in control-rod mechanisms. In this generator, the frequency is directly proportional to the speed at which the field system is rotated; when it is held stationary, the output frequency is also held at the zero value. A diagram is given for a low-frequency 3-phase generator with an exciter. (D.L.C.)

24335

IMPROVEMENTS IN OR RELATING TO SCALING CIRCUITS. Ernest Franklin (to United Kingdom Atomic Energy Authority). British Patent 841,613. July 20, 1960.

A magnetic memory ring scaling circuit for counting electric pulses is described in which each core carries only one winding. The circuit comprises a series of high-remanence magnetic cores having windings and condensers and is arranged so that cores are changed from one direction of magnetization to the other by input pulses and the discharge currents from the condensers reverse once again to the adjacent cores. Circuit diagrams are given for scale-of-ten and scale-of-five ring scalers. (D.L.C.)

24336

IMPROVEMENTS RELATING TO ELECTRICAL DISCHARGE TUBES. George William Buckley (to Metropolitan-Vickers Electrical Co., Ltd.). British Patent 842,261. July 27, 1960.

Electric discharge tubes of the klystron type can be modified so that a vacuum can be maintained along with maximum transmission and minimum reflection of the emitted electromagnetic waves. This is done by an output waveguide of elliptical cross section sealed by a circular sheet of dielectric material transparent to the electromagnetic waves. The dielectric sheet is oriented obliquely to the waveguide axis, and, in order to prevent damage of the sheet by γ or x radiation from electron bombardment, an elbow is inserted in the waveguide between the sheet and the discharge tube. (D.L.C.)

24337

CALUTRON ION SOURCES. (to United Kingdom Atomic Energy Authority). British Patent 843,171. Aug. 4, 1960.

A calutron ion source was designed which offered shielding of the filamentary cathode by a plate-shaped arc cathode which can better withstand positive ion bombardment. Besides the two cathodes, which are separated by a control collimating electrode, there is a plate-shaped arc anode separated from the arc cathode by a collimating electrode and a hollow arc block. (D.L.C.)

24338

ION SOURCE FOR CALUTRONS. (to United Kingdom Atomic Energy Authority). British Patent 843,172. Aug. 4, 1960.

A calutron ion source was designed which is comprised of an arc chamber into which electrons are fed by an electron-emissive arc cathode and into which the gaseous material to be separated is fed at a plurality of places. Control of the electron feed is achieved by varying the potentials of three points of the cathode connected to a source of current. (D.L.C.)

24339

IMPROVEMENTS RELATING TO ELECTRICAL POSITIONAL CONTROL APPARATUS. Leslie Carter Ludbrook (to British Thomson-Houston Co., Ltd.). British Patent 843,830. Aug. 10, 1960.

A description is given of an electrical positional control apparatus having large torque and therefore suitable for controlling hoists for raising and lowering reactor control rods. The apparatus is of the type comprising a transmitter electrically connected to a motor whose positioning will then depend on the transmitter rotor positioning. The a-c generator has a stator of a plurality of phase windings and a rotor supplied with single-phase a-c voltage, and the motor has a stator with a number of phase windings equal to that of the generator stator windings and a permanent magnet or a d-c excited rotor. The output of the generator stator is rectified and passed through a reversing switch to the motor to cause it to rotate in step with the rotation of the generator. (D.L.C.)

24340

IMPROVEMENTS IN OR RELATING TO A DEVICE FOR MEASURING THE RADIO-ACTIVITY OF A LIQUID OR A MIXTURE OF SOLID AND LIQUID MATERIALS. (to Philips Electrical Industries Ltd.). British Patent 843,875. Aug. 10, 1960.

A device for measuring the radioactivity of a liquid or a suspension of solid in liquid is described in which a G-M tube in the shape of an annular envelope is immersed in the liquid up to its neck with liquid in the interior part of the tube. The two immersed electrodes can be out of contact with the tube, one in the interior part filled with liquid and the other in the outside liquid, or one of the electrodes can contact the interior part via a conductive coating. The tube is filled with a gas mixture of an inert gas and >0.001% halogen. (D.L.C.)

24341

IMPROVEMENTS IN REMOTE CONTROL DEVICES. Stanley Dean (to Commissariat à l'Énergie Atomique). British Patent 843,941. Aug. 10, 1960.

A remote control device was invented which eliminates most of the gears, pulleys, and cables usual on such devices for handling radioactive materials behind a shield. The device comprises two frames, one actuated by the operator and the other carrying manipulation means, e.g., tongs; the two frames are connected together by three identical mechanisms whereby a motion of the first frame is transmitted to the second. The manipulation means is actuated by means of flexible cable. Drawings are given for a configuration of the invention where pivotal connections between the mechanisms and the frames are cardan joints and the whole device is counter-balanced for maximum sensitivity of operation. (D.L.C.)

24342

IMPROVEMENTS IN OR RELATING TO VOLTAGE PEAK VALUE COMPARISON CIRCUITS. Daniel Fraser Davidson. (to United Kingdom Atomic Energy Authority). British Patent 843,956. Aug. 10, 1960.

A voltage peak comparison circuit was invented for the amplitude comparison of small voltage pulses from a mass spectrometer whose magnet current is varied cyclically so that beams of different masses are scanned over the collector plate. The circuit comprises an amplifier of variable gain, a group of condensers to be charged in turn from the amplifier, means for comparing those charges, and means for discharging each condenser by a small amount before recharging. When the beams from two isotopes alternately scan the collector plate, alternate current pulses are set up having a ratio equal to the isotope abundance ratio and are led to the capacitors via the amplifier circuit where their peak voltages are compared by a valve voltmeter and a potentiometer. Since the beam currents are not constant, there is a possible source of error in allowing the capacitors to charge to the highest peak voltage, and means is provided for discharging by a small fraction just before the peak voltage of the scan is reached. (D.L.C.)

24343

IMPROVEMENTS RELATING TO VOLTAGE MEASURING APPARATUS. William Percival Baker (to Metropolitan-Vickers Electrical Co., Ltd.). British Patent 844,169. Aug. 10, 1960.

A capacitance potential divider circuit was invented for measuring the voltage of pulses from high-voltage pulse generators such as those for particle accelerators; thereby, the usual difficulties of resistance potential dividers are avoided. In operation, this circuit is connected across the generator transformer output with a tapping point connected to a voltage measuring circuit and a switch for connection to a reference voltage between successive transients. This switch may be controlled by the generator. (D.L.C.)

24344

IMPROVEMENTS IN OR RELATING TO DEVICES FOR DETERMINING THE RADIO-ACTIVITY OF SOLID MATERIAL DISSOLVED OR SUSPENDED IN A LIQUID. (to Phillips Electrical Industries Ltd.). British Patent 844,733. Aug. 17, 1960.

A method for determining the radioactivity of a solid in a liquid is described in which the disadvantages of the Al-foil method (irregular evaporation and nonhomogeneous dried layers) are avoided. The method consists of dripping the liquid on a porous layer with a heating element under it, e.g., asbestos, and limiting the area of evaporation by a metal ring; a vapor layer forms around the liquid, preventing creeping or uneven drying. The radioactivity of dried residue is then determined. (D.L.C.)

24345

IMPROVEMENTS IN OR RELATING TO TIME INTERVAL ANALYSERS. (to Commissariat à l'Énergie Atomique). British Patent 844,763. Aug. 17, 1960.

A time interval analyzer is described in which delay lines are used for propagating gate signals for separation of events A of a first kind from events B of a second kind. Such an analyzer has several advantages over conventional ring counters. These advantages are that shorter time intervals (<1 μsec) can be used, the cost is lower, and simple coincidence is used in place of triple coincidence, thereby simplifying the circuits. For 20 to 100 taps for short time intervals, such delay-line analyzers are best but for <10 time intervals, ring counters may be better. Provision is made for correcting signal deformation by regeneration circuits and for phasing the pulses with the center of the gate signals. (D.L.C.)

24346

IMPROVEMENTS IN OR RELATING TO PHOTOMULTIPLIER TUBES. John Raymond Hartley (to United Kingdom Atomic Energy Authority). British Patent 845,618. Aug. 24, 1960.

A photomultiplier tube was invented for measuring intensities of several optical images focused on different photocathode areas on the tube wall; it has control electrodes for gating photoelectrons from the cathode. Several configurations of the photomultiplier tube are shown and described. (D.L.C.)

24347

IMPROVEMENTS IN AND RELATING TO NUCLEAR ELECTRIC GENERATORS. (to Radiation Research Corp.). British Patent 845,701. Aug. 24, 1960.

A nuclear electric generator is designed for overcoming loss of potential owing to secondary emission without recourse to suppressor electrodes which intercept a large fraction of the primary electrons; this is done by using material of low secondary emission ratio (<1) for the collector electrode. The generator comprises two-spaced electrodes in an evacuated envelope, one electrode being an emitter of charged particles from nuclear reactions and the other being a collector. In the design, the emitter is sorbed tritium and/or Ni^{63}, both beta emitters, and the collector is an element of atomic number less than 10, usually porous carbon, beryllium, or lithium. Several configurations of this basic design are shown, and performance curves (output current vs. output potential) are compared with those yielded by other collector materials; for tritium emitter and carbon collector, the current decreases with potential down to 20 $\mu\mu$a at 30 volts and thereafter remains steady. (D.L.C.)

24348
IMPROVEMENTS IN OR RELATING TO CALUTRONS. Ernest Orlando Lawrence. British Patent 845,881. Aug. 24, 1960.

An improved calutron of the arc-multiple ion-beam type was invented in which the arc blocks of the arc source are insulated from each other and the individual ion beams are focused on a single receiver. Complete details of the design are given. This calutron is particularly suitable for separating uranium isotopes using UCl_4. (D.L.C.)

24349
IMPROVEMENTS IN OR RELATING TO RADIATION DETECTORS. James Dwyer McGee and Hugh Devereux Evans (to National Research Development Corp.). British Patent 846,108. Aug. 24, 1960.

A radiation detector capable of indicating the radiation intensity pattern over an area instantaneously instead of line by line was invented for observing movement of radioactive tracers, e.g., in biological systems. The detector comprises three layers, the first and third being phosphors and the second a photoemissive material; and between the second and third layers there is an electron multiplying grid electrode plurality forming channels. In this detector, a radiation image is divided into elements by the channels and reconstructed into a visual image on the third layer. (D.L.C.)

24350
IMPROVEMENTS IN MEASURING APPARATUS EMPLOYING BETA RAYS. Graham Boyce Wills (to British Insulated Callender's Cables, Ltd.). British Patent 846,416. Aug. 31, 1960.

A sensitive measuring apparatus comprising an electron source and a backscattering detector was invented for measuring coating thicknesses and mixture proportions of two materials of different backscattering properties. It is designed so that, by limiting the detector response to electrons having an energy above a predetermined level, magnification factors of more than 2 are obtained. Complete details of the design and operation are given. (D.L.C.)

Materials Testing

24351 HW-64562
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ULTRASONIC INSPECTION OF PRTR FUEL ELEMENT CLADDING. P. L. Farnsworth and T. G. Lambert. Apr. 1, 1960. 19p. Contract AT(45-1)-1350. OTS.

An immersion ultrasonic test was developed which will detect small cracks on the inner surface of Zircaloy-2 tubing used for PRTR fuel-element cladding. The ultrasonic method was compared with fluorescent-penetrant and eddy-current tests and found to be the most sensitive to crack type defects. The method is not sensitive to bonded inclusions or to wall-thickness variations. The development, evaluation, and application of this test are described. (auth)

24352
NON-DESTRUCTIVE METALLOGRAPHY OF LIGHT AND ULTRA-LIGHT MATERIALS (ALUMINUM, MAGNESIUM, BERYLLIUM, AND THEIR ALLOYS). Pierre A. Jacquet (Constructions et Armes Navales, [France]). Rev. aluminum 37, 713-20(1960) June. (In French)

The electrolytic plug ("Ellopol" process) performs, on small specimens as well as on every accessible area of a part, the polishing and anodic processes required in optical and electronic metallography. When the shape or size of the object does not allow direct observation under the microscope, a print of the surface is substituted; the print is obtained with a special varnish; it can also provide a backing to a carbon film which will be examined in the electronic microscope. The combination of the two process (local preparation and replica) leads to a new form of metallography, referred to as non-destructive. Offering interesting applications in metallurgical investigations, this process is most suitable for production line checks and for finished articles. The transparency of the replica simplifies conditions of observation. The present report, limited to the light and ultra-light metals and alloys used in the aircraft and nuclear industries, describes the main points of the processes and provides some examples of the results obtained. (auth)

GEOLOGY, MINERALOGY, AND METEOROLOGY

24353 BLG-45
Brussels. Centre d'Étude de l'Énergie Nucléaire.
CONTRIBUTION A L'ETUDE DE LA MINERALOGIE, DE LA GEOCHIMIE ET DES METHODES DE PROSPECTION DES CARBONATITES A PYROCHLORE AU MOYEN DES RAYONS X. (Contribution to the Study of Mineralogy, Geochemistry, and Methods of Prospecting for Carbonatites with Pyrochlore Using X Rays). L. Van Wambeke. [1960?]. 62p.

The investigation of niobium-bearing carbonatites and the determination of the niobium content in mineral samples by x-ray fluorescence methods of analysis are reported. In addition, some practical applications of x-ray methods in the field of mineralogy, geochemistry, and ore prospecting are discussed. The main sources of niobium at present are found in granites, granitic pegmatites, and in derived alluvial or eluvial deposits. On the other hand, simple carbonatite deposits appear to be the main future source of niobium. X-ray fluorescence was used in preliminary prospecting for a rapid and semi-quantitative determination of niobium and other associated chemical elements (Sr, Ba, and rare earths) in mineral samples. Radiometric prospecting is also helpful in the search for niobium-bearing carbonatites, especially when complemented with x-ray or optical spectroscopic analyses. In conjunction with field measurements (radiometry and paper chromatography), a niobium-bearing carbonatite was discovered in the Belgian Congo by means of x-ray spectroscopic analyses. Methods that are convenient for rapid estimation of the niobium content in soils, carbonatites, and superficial manganese-iron ores were developed. These methods have a relatively good accuracy (less than 12%) and sensitivity (5 ppm to 20 ppm of Nb). Moreover, their efficiencies are much higher than the other proposed methods of niobium analysis. Between 100 and 200 analyses can be processed per day per man. The only disadvantage is related to the fact that the measurements must be made in a laboratory. (auth)

24354 NDRE-IR-F-350
Norway. Forsvarets Forskningsinstitutt, Oslo.
RADIOACTIVE FALLOUT IN NORWAY UP TO NOVEMBER 1957. T. Hvinden. Nov. 12, 1957. 24p. (A/AC.82/G/R.144).

A review was made of airborne and settled radioactive dust monitoring in Norway, and of radioactive material in drinking water. Monthly means of daily measurements of the airborne radioactive dust at ground level for the months July through October 1957 were determined for stations at Kjeller, Gardemonen, Sola, Finse, Bergen, Värnes, Tromsö, and Vadsö. The total β activity in $\mu\mu$c/kg air was measured at different altitudes from December 1956 to November 1957. The cumulative fall-out was measured at Kjeller, Bergen, Kjevik, Sola, Värnes, Bodö, and Bardufoss. The fall-out activity in $\mu\mu$c/liter drinking water was also measured. The average Sr^{90} activity at Kjeller was calculated as 1.3 $\mu\mu$c/liter precipitation. The measurements showed a tendency to an increase in the average rate of fall-out in Norway. (M.C.G.)

24355 RME-1075(Rev.)
Grand Junction Operations Office. Production Evaluation Div., AEC.
AIRBORNE AND GROUND RECONNAISSANCE IN THE ESPANOLA AREA, SANTA FE COUNTY, NEW MEXICO. G. E. Collins and R. E. Freeland. Oct. 1956. 16p. OTS.

Two areas, one near Petaca and the other extending southeast from Espanola to Tesuque in north-central New Mexico, were covered by airborne radiometric surveying in Nov. 1954. Of the 15 anomalies published as a result of the survey, 14 were in the Santa Fe formation of Pliocene age southeast of Espanola and one in an unidentified sandstone in the Petaca area in northern New Mexico. (auth)

24356 AEC-tr-4100
RADIOHYDROGEOLOGY. (Radiogidrogeologiya). A. N. Tokarev and A. V. Shcherbakov. A translation from a publication of the State Publishers of Scientific-Technical Literature on Geology and Conservation of Natural Resources, Moscow, 1956. 353p. OTS.

This volume consists of two parts. In Part one the condition of enrichment of natural waters with radioactive elements, types of natural radioactive waters and their formation, and hydrogeological conditions of the formation and breakdown of uranium deposits are discussed. In Part two a discussion is given for organizing and conducting radiohydrogeological investigations, procedural instructions concerning interpretation of radiohydrogeological data, methods of determining the radioactivity of water and gases, methods of computing the resources of radioactive waters, and cameral work. (W.L.H.)

24357 CEA-tr-R-769
DOSAGE DU ZIRCONIUM DANS LES MINERAIS A L'AIDE DE SPECTRES DE FLUORESCENCE DE RAYONS X. (Determination of Zirconium in Ores Using X-ray Fluorescence Spectra). N. F. Losev (P. F. Lossev) and A. N. Glotova. Translated into French from Zavodskaya Lab. 24, 619-21(1958). 7p.

An x-ray fluorescence method for determination of Zr in enriched ores is offered. A URS-70 high-voltage source was used, and the spectrum is excited by radiation from a Ag anode. The x-ray tube operated at 55 kv and 10 ma. The external standard technique was used with the $K\alpha_1$ line of Zr in first-order reflection wavelength 7.843. The effects of certain factors on precision of the measurement of the intensity of the line and on composition effects are discussed. (T.R.H.)

24358
A METHOD FOR IDENTIFYING PARTICULATE FLUORIDE COMPOUNDS. Barbara J. Tufts (Univ. of Chicago). Anal. Chim. Acta 23, 209-14(1960) Sept. (In English)

A method is described for identifying particulates containing fluorides and other complex fluorine compounds such as fluosilicate in samples collected on membrane filters. The filter is treated with lead chloride to precipitate lead chlorofluoride at each fluoride-containing spot. This microspot is identified by examination in a light microscope. Sulfate and phosphate, which precipitate if present, can be distinguished and do not interfere. Calibrations are given for the fluorides and the more insoluble salts, relating the original particle size to the reaction site size. Thus the mass of the particles can be calculated. Results of some field tests in an area of fluoride pollution are given and compared with standard testing procedures. (auth)

24359
THE DEUTERIUM CONCENTRATION OF PRECIPITATIONS IN TERRE DE VICTORIA, ANTARCTICA. René Botter, Claude Lorius, and Guy Nief. Compt. rend. 251, 573-5(1960) July 25. (In French)

The deuterium concentration of precipitations collected at the soil increases almost linearly with their temperature of formation estimated from radio soundings. It appears possible to utilize this relationship for the study of questions of a glaciological and meteorological character. (tr-auth)

24360
ORIGIN OF Be^{10} AND Al^{26} IN TEKTITES. R. D. Cherry and S. R. Taylor (Univ. of Cape Town, South Africa). Geochim. et Cosmochim. Acta 17, 176-85(1959) Nov.

It is shown that the recently reported amounts of Be^{10} and Al^{26} in tektites can possibly be explained in terms of Urey's "comet" hypothesis for tektite origin. On the basis of calculations, a level of Be^{10} activity similar to that reported by Ehmann and Kohman (1958) was obtained, but the level of Al^{26} was somewhat lower. It is shown that by mixing one part of chondritic silicate, which is assumed to represent the nonvolatile comet material and to contain the radioactive nuclides, with thirteen parts of arkose-like material, the over-all tektite composition can be accounted for rather satisfactorarily. (auth)

24361
METEORITE OF BREITSCHEID. [PART] I. F. A. Paneth (Max-Planck-Institut für Chemie, Mainz). Geochim. et Cosmochim. Acta 17, 315-19(1959) Nov. (In German)

On August 11, 1956, a stone meteorite, the weight of which was supposed to be about 1.5 kg, fell at Breitscheid in the Dillkreis (50° 51′ N, 8° 12′ E); but, before recognition of its meteoritic character, the stone was broken to pieces so that the total weight of the fragments amounted only to 970 g. The petrographic examination showed in thin sections a multiplicity of most characteristic chondrules; the Breitscheid meteorite is a bronzite–olivine–chondrite. It is remarkable that troilite was found in primary as well as in secondary formation and that ilmenite could be proved to be a meteoritic mineral. The total chemical analysis corresponds very well with the petrographic results. Helium, neon, argon, tritium, potassium, and uranium were measured by special methods developed during the course of work. It was found that the isotopic composition of helium and neon greatly differs from that of the corresponding terrestrial gases. A geological age of 3300 million years results from the argon/potassium ratio. The content of helium and neon differs widely in various parts of the meteorite; a phenomena which has to be explained in detail. An irradiation age of about 20 million years for the Breitscheid meteorite would result from the ratio helium-3 to tritium in one part of the meteorite. (auth)

24362

THE RHODIUM, SILVER AND INDIUM CONTENT OF SOME CHONDRITIC METEORITES. U. Schindewolf and M. Wahlgren (Univ. of Michigan, Ann Arbor). Geochim. et Cosmochim. Acta 18, 36-41(1960) Jan. (In English)

By neutron activation analysis the rhodium, silver, and indium content of five chondritic meteorites was determined. The average data are 0.186 and 0.094 ppm for rhodium and silver. The upper limit for the indium content is 0.001 ppm. The values for rhodium and silver are in fair agreement with the data estimated by Suess and Urey; the indium values are lower by a factor of 100 or more. (auth).

24363

A METHOD OF ANALYSIS OF OXYGEN ISOTOPES IN ORTHOPHOSPHATE—ITS USE IN THE MEASUREMENT OF PALEOTEMPERATURES. A. P. Tudge (Univ of Chicago). Geochim. et Cosmochim. Acta 18, 81-93(1960) Jan. (In English)

An analytical procedure is presented for the determination of the O^{18}/O^{16} ratio in orthophosphate and condensed phosphate. In the described procedure the phosphate is first purified and then precipitated as $BiPO_4$. The phosphate oxygen is released by the reaction ($BiPO_{4(s)} + 8/3\ BrF_{3(l)} \rightarrow BiF_{3(s)} + PF_{5(g)} + 4/3\ Br_{2(g)} + 2\ O_{2(g)}$), then purified and mass spectrometrically analyzed. The method is quantitative, free from isotopic fractionation and exchange, and precise to ±0.15%. A correction can be made for the contaminating effect of water oxygen introduced during the hydrolysis of the condensed phosphates. The possibilities are given for the use of this procedure in the measurement of paleotemperatures. (auth)

24364

THE SEDIMENTARY GEOCHEMISTRY OF THE BERYLLIUM ISOTOPES. J. R. Merrill, E. F. X. Lyden, M. Honda, and J. R. Arnold (Princeton Univ., N. J.). Geochim. et Cosmochim. Acta 18, 108-29(1960) Jan. (In English)

The sedimentary geochemistry of beryllium was investigated with a view toward the use of cosmic-ray-produced Be^{10} for geochronology. Analyses of some Pacific ocean water samples give an average total beryllium content of 6×10^{-13} parts per part (ppp), less than half of which is retained by a Millipore filter. The concentration of Be^9 in five deep ocean sediment cores ranges from 2 to 3 ppm. These data indicate an ocean residence time for beryllium of about a few hundred years. Analyses of river water give concentrations of about 10^{-10} ppp, substantiating this residence time. An abrupt change in Be^{10} content with depth in a Pacific sediment core correlates with a change in the ionium-thorium ratio reported by Goldberg and Koide for the same core. (auth)

24365

NEUTRON ACTIVATION RESULTS FOR VANADIUM AND SCANDIUM IN G-1 AND W-1. D. M. Kemp and A. A. Smales (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Geochim. et Cosmochim. Acta 18, 149-50 (1960) Jan. (In English)

The reported vanadium content of the "standard" rocks G-1 and W-1 range from 8 to 38 ppm and 170 to 340 ppm, respectively. The results found in neutron activation work on G-1 and W-1 for vanadium and scandium are compared with those obtained by others. The results obtained for vanadium on W-1 (CaO 10.96%) favor those of Shaw using V 3185 A, the line not recommended, and differ notably for the line which he recommends, 3102 A. The results for scandium reinforce the values recommended by Ahrens for both G-1 and W-1. (B.O.G.)

24366

K—A[r] AND Rb—Sr MINIMUM AGES FOR THE PENNSYLVANIAN SECTION IN THE NARRAGANSETT BASIN. P. M. Hurley, H. W. Fairbairn, W. H. Pinson, and G. Faure (Massachusetts Inst. of Tech., Cambridge). Geochim. et Cosmochim. Acta 18, 247-58(1960) Feb. (In English)

K—Ar and Rb—Sr age measurements on metamorphic minerals in the Rhode Island and Wamsutta formations of Pennsylvanian (Allegheny) age in the Narragansett Basin, R.I., indicate that the minimum age of these formations is 255 million years. Intrusive granites cutting the Wamsutta formation show a minimum age of 235 million years. The fairly widespread orogenic event in the Appalachians that caused metamorphism and igneous rock emplacement showing ages in this range is therefore post lower Pennsylvanian and should be referred to as Appalachian rather than Acadian. The concordant lead ages in the pegmatites of Middletown, Conn., are of this age; and as these were used as the basis of a Devonian age point in the present time scale of Holmes, it is clear that the scale must be lengthened. These results are in accordance with a new value of 360 million years for the minimum age of the lower Devonian, which was reported earlier. (auth)

24367

ISOTOPIC RATIOS OF OXYGEN IN METEORITES AND IGNEOUS ROCKS. A. P. Vinogradov, E. I. Dontsova, and M. S. Chupakhin (Vernadskiĭ Inst., Moscow). Geochim. et Cosmochim. Acta 18, 278-93(1960) Feb. (In English)

Data are included referring to 16 different igneous rocks and 16 different meteorites. The rocks were reduced by carbon at 1200 to 2000°C for a yield of 30 to 40 cm^3 carbon monoxide at 760 mm Hg. For quartz and granite, the reduction reaction becomes noticeable at 1300° to 1400°C; at 1200°C for dunite and olivine; and at 1000° to 1100°C for basalt, diabase, and the matter of stony meteorites. The reduction reactions for all samples were practically finished at 1900°C. The CO yield for the different objects was 95.0 to 100% with a determination accuracy of ±0.05%. (B.O.G.)

24368

NICKEL IN TEKTITES BY ACTIVATION ANALYSIS. W. D. Ehmann (Univ. of Kentucky, Lexington). Geochim. et Cosmochim. Acta 19, 149-55(1960) July. (In English)

The nickel abundances of most of the major occurrences of tektites, as well as several meteorite impact glasses and obsidians, were determined using neutron activation analysis. Iron abundances were determined in the same specimens; and Ni/Fe abundance ratios were tabulated. These ratios, determined that for the first time on the Libyan Desert glass, the Ivory Coast tektites, and the bediasites, indicated all these specimens fall within the known range of this ratio for the other tektite occurrences. On the basis of this ratio, major differences were observed among specimens from the indochinite tektite occurrence, but no significant differences were observed among specimens from three separate philippinite sites. The differences in the Ni/Fe ratios for tektites and known meteorite impact glasses suggested different modes of formation. (auth)

24369

THE ESTIMATION OF THE OXIDATION STATE OF PITCHBLENDE IN ORES. L. G. Stonhill (Eldorado Mining and Refining Ltd., Ottawa). Geochim. et Cosmochim. Acta 19, 168-76(1960) July. (In English)

The uranyl fluoride content of fully hydrofluorinated uranium oxides, whether pure or mixed with the oxides of a number of other metals, is a practical measure of the original U(VI) content. This observation forms the basis for determining the oxidation state of pitchblende when more precise methods are inapplicable. Metallic and carbonaceous contamination must be absent, and the sulfide content of the ore must be reduced to the level of a few per cent relative to the uranium content by means of ore-dressing techniques. The method involves reacting the finely ground concentrate to constant weight with anhydrous hydrogen fluoride gas at a maximum temperature of 350°C in a thermobalance modified for work with corrosive gases. Uranyl fluoride is leached from the product with cold saturated aqueous sodium fluoride, and uranium tetrafluoride is dissolved from the residue with hot ammonium oxalate solution. In each case, the extracted uranium is determined either spectrophotometrically or fluorimetrically. Application to problematical ores other than pitchblende, such as davidite, is envisaged. (auth)

24370

THE RECORD IN THE METEORITES. I. THE FORMER ENVIRONMENT OF STONE METEORITES AS DEDUCED FROM K^{40}–Ar^{40} AGES. G. G. Goles, R. A. Fish, and E. Anders (Univ. of Chicago). Geochim. et Cosmochim. Acta 19, 177-95(1960) July. (In English)

The K–Ar ages of meteorites are systematically lower than the Rb–Sr and Pb–Pb ages, owing to diffusion losses of argon. An equation is derived that gives the apparent K–Ar age as a function of the "true" age and the parameter D/a^2, which is the diffusion constant of Ar^{40} divided by the square of the radius of the potassium-bearing grains. The dependence of D/a^2 in stone meteorites on temperature may be obtained from the work of Geiss and Hess; so that given a "true" and an apparent age, it is possible to deduce an upper limit to the mean temperature at which a meteorite was held since the cessation of strong heating in its parent body. The activation energy for the diffusion of radiogenic Ar^{40} from meteorites is unexpectedly small (14 kcal/mole); so that for a group of eight dated chondrites, the upper limit to the mean environmental temperature is found to be $\leq$ 196°K. This low value implies that the parent body of the chondrites was no closer to the sun than 1.44 astronomical units and no larger than 250 km in radius, for radiation temperatures are higher near the sun; long-lived radioactivities produce higher temperatures in bodies as large as 300 km in radius. The compatibility of these limits with current theories on the origin of meteorites is examined, and some crucial experiments are proposed. Further diffusion losses will occur after the release of the meteorites from their parent bodies. Consideration of the radiation temperature of a meteorite in space shows that even for perihelia barely within the earth's orbit, some 10 to 20% of the radiogenic and cosmic-ray induced argon will be lost in times of the order of typical exposure ages of chondrites. (auth)

24371

PRODUCTION OF TRITIUM IN NUCLEAR SPALLATIONS. S. F. Singer (Univ. of Maryland, College Park). Geochim. et Cosmochim. Acta 19, 216-17(1960) July. (In English)

Production cross sections for tritium were measured in cyclotron targets and were quoted as 53, 62, and 130 mb. These are compared with values deduced from cosmic-ray bombardment of iron meteorites, where a direct tritium measurement gave 280 mb, whereas He^3 : He^4 ratio measurements led to at least 215 mb and possibly as high as 410 mb. Hence application of cyclotron cross sections may lead to too high values for the cosmic-ray ages of meteorites. (auth)

24372

RELATIONSHIPS BETWEEN GEOLOGY AND COMPOSITION OF SOME PEGMATITIC MONAZITES. E. William Heinrich (Univ. of Michigan, Ann Arbor), R. A. Borup, and A. A. Levinson. Geochim. et Cosmochim. Acta 19, 222-31 (1960) July. (In English)

Fourteen monazites from several well-studied pegmatites and pegmatite districts in the western states were analyzed by x-ray fluorescence spectrometry for the cerium subgroup of rare-earth elements and for yttrium and thorium. The results were correlated with the paragenesis, mineralogy, and geology of the occurrences. They show several distinct, and in some cases unique, rare-earth element distributions which are characteristic not only of individual pegmatites but also of entire pegmatite districts. (auth)

24373

NEPTUNIUM-239 CONTENT IN THE RADIOACTIVE RAIN WATER COLLECTED IN JAPAN DURING THE PERIOD OF 1954-1958. A GRAPHICAL METHOD OF DETERMINING THE Np-239 CONTENT AND OF ESTIMATING THE DATE OF NUCLEAR EXPLOSIONS. Seitaro Koyama (Niigata Univ., Japan). J. Fac. Sci., Niigate Univ. Ser. I, 2, 107-19 (1960) May. (In English)

Radioactive rain water collected in Japan during the period 1954 to 1958 was analyzed radiochemically, and the results concerning Np^{239} and U^{237} content are reported. Each gross decay curve was carefully examined, and it was confirmed that the curve plotted on a full-logarithmic paper was not a straight line as was formerly believed but a broken-arrow shaped line. The differences in radioactivity between the former branch and the backwards extrapolated portion of the latter branch correspond to the content of nonfission-produced nuclides of short life. Agreement between the graphically estimated and the radiochemically determined values was fairly good. The fact that the "joint" of the two branches of the decay curve is situated at the nineteenth day after fission is utilized to determine the date of explosion. The influences of the coexistence of U^{237} are discussed. The confirmation of the non-linearity of the gross decay curve in the case of a 3F-bomb explosion made it possible to disentangle the problem of estimating the date of explosions in the cases of rainfalls in May 1954 and September 1954. (auth)

24374

A DROP OF THE LEVEL OF ATMOSPHERIC AIR RADIOACTIVITY AS THE RESULT OF CESSATION OF NUCLEAR WEAPON TESTS. Yu. V. Novikov and I. P. Korenkov (Erisman Moscow Research Inst. of Sanitation and Hygiene). Med. Radiol. 5, No. 7, 66-71(1960) July. (In Russian)

The results are given of investigations of atmospheric radioactivity due to long-living β-active fission products. The probable level of specific β activity of nuclides in the surface layers of the atmosphere during March–June 1959 comprised 3.8×10^{-15}, whereas in January 1960, it was 1.9×10^{-16}. Thus, the pollution of the atmosphere with β-active long-living nuclides decreased by 20 times. Such a drop could be associated with the one-year cessation of tests of nuclear weapons. (auth)

24375

STRONTIUM 90 IN WESTERN NORTH PACIFIC SURFACE WATERS. Y. Miyake, K. Saruhashi, and Y. Katsuragi

(Meteorogical Research Inst., Tokyo). Papers Meteorol. and Geophys. (Tokyo) 11, No. 1, 3p.(1960).

The oxalate method, followed by Ca masking with EDTA, was used to determine the amount of Sr^{90} in Western North Pacific surface waters. The yield of 80% for the strontium was reproduced satisfactorily. The activity of the Sr^{90} after separation was measured with a thin-wall counter. The concentration of Sr^{90} was found to be more than ten times as large as that of Atlantic waters. (M.C.G.)

24376

RESERVES AND AVAILABILITY OF URANIUM. F. Ippolito (Comitato Nazionale per le Ricerche Nucleari, Rome). Rend. AEI (Venezia), 2p.(1959) Sept.-Oct. (In Italian)

The results of uranium search in Italy and in the world are shown. Data concerned with known reserves and production are given. Some forecasts for the coming years are included. (auth)

24377

STUDIES IN DETECTING RADIO-ACTIVE FALL-OUT. E. C. Winkler (Peter MacCallum Clinic, Melbourne). p.127-37 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

A steady increase in the number of stations for the measurement of radioactive fall-out can be observed. The most common method of measurement is the sticky-paper method, but an interest channeled toward other methods of detection is presented. The fission-products liberated upon the explosion of a nuclear weapon are returned to earth in three ways. These are as follows: (1) They can become attached to particles thrown up in the explosion and fall out in the immediate vicinity; (2) they can be thrown up into the stratosphere and fall out within a few hundred miles of the test site; and (3) mainly by a thermonuclear explosion, they can be forced into the stratosphere where they circle the earth and fall out gradually over a period of years. A study was made of the detection methods for fission products in the atmosphere in Melbourne. The investigation was made to ascertain that samples of unusual activity were actually bomb debris and to trace their origin. (B.O.G.)

24378

FALL-OUT MEASUREMENTS IN AUSTRALIA. L. J. Dwyer, J. H. Martin, and E. W. Titterton (Australian Atomic Weapons Tests Safety Committee). p.138-46 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

The Australian fall-out monitoring network has operated continuously since May 1956. Information gained from local tests confirmed that the radioactive material reaching the ground conforms to the predicted pattern. During periods between local testing operations, data are furnished on fall-out from tests conducted elsewhere. With a view to assessing hazards as they are related to fall-out over Australia, the thyroids of sheep grazing close to test sites were examined for radioiodine shortly after each local test. A wide-scale program entailing the collection of biological and geophysical materials and their analysis for Sr^{90} is now in progress. (B.O.G.)

24379

Geological Survey, Washington, D. C.

BOTANICAL PROSPECTING FOR URANIUM IN THE DEER FLAT AREA, WHITE CANYON DISTRICT, SAN JUAN COUNTY, UTAH. Albert J. Froelich and Frank J. Kleinhampl. Geological Survey Bulletin 1085-B. 1960. 35p., 1 ills. $0.65(GPO).

The plant-analysis method of botanical prospecting for concealed uranium deposits was employed from May to July 1953, in the Deer Flat area, White Canyon district, San Juan County, Utah. About 2,000 samples of tips of branches from as many junipers and pinyons were systematically collected along about 27 miles of outcrop of the Shinarump member of the Chinle formation of Triassic age or of laterally equivalent units and were analyzed in the laboratory for uranium content. Anomalously large amounts of uranium absorbed by trees imply a nearby source, which may be an ore deposit. The indicator-plant method of prospecting did not prove very useful in the Deer Flat area. Botanically defined anomalies occur at all major known deposits at Deer Flat. Other botanically defined anomalies may reflect previously unknown mineralized parts of the Shinarump member. The distribution of botanical anomalies suggests that the south half of the Deer Flat area is much more favorable for concealed uranium deposits than the north half. Additional physical exploration is recommended at Deer Flat to test the validity of the plant-analysis method of prospecting for uranium. The finding of mineralized ground at botanical anomalies would verify the reliability of the botanical-prospecting method for defining mineralized areas. (auth)

HEALTH AND SAFETY

24380 A/AC.82/G/L.392

Japan. National Hygiene Lab., Tokyo.

RESEARCH ON RADIOACTIVITY IN STOCK RAIN WATER OF LIGHTHOUSES IN JAPAN. Kakuma Nagasawa, Shōichi Kawamura, and Akira Tanaka. May 1960. 9p.

In 1958, the radioactivity was measured in 161 samples of rain water impounded for drinking at 7 lighthouses in Japan. The values ranged from 32 to 162 cpm/liter for unfiltered water and 5.9 to 20.8 for filtered water. (T.R.H.)

24381 A/AC.82/G/L.398

Tokyo Univ. Botanical Inst.

CYTOLOGICAL EFFECT OF HOT RAIN. Nobunori Tanaka, Michiko Kohnō, and Akie Sugimura. May 1960. 13p.

Frequency of chromosome aberrations was studied in root tips of Tradescantia paludosa in two plots, one under glass and one in the field. The experiment was carried out during the rainy season (June-July) in Tokyo in 1957, 1958, and 1959. The radioactive rain seems to increase the frequency of chromosome aberrations. (T.R.H.)

24382 AF-SAM-60-35

Texas. Univ., Austin. Radiobiological Lab. and School of Aviation Medicine, Brooks AFB, Tex.

A CORRELATION ANALYSIS OF THE RELATIONSHIP BETWEEN WEATHER VARIABLES AND ATMOSPHERIC RADIOACTIVITY. J. A. Davis, Loren C. Logie, Eddie M. Robinson, and B. S. Heathington. Oct. 15, 1959. 8p.

Correlation analysis between various surface weather parameters and samples of atmospherically borne radioactive material was performed. The material collected was primarily of natural origin (i.e., Rn and Th). The analysis suggests that the natural radioactive material is transported into the Austin area within the turbulence associated with a cold frontal passage and concentrated in the lower air layers by the ensuing elevated-temperature inversion. (auth)

24383 BIO-03-60

Italy. Comitato Nazionale per le Ricerche Nucleari, Rome. DATA ON ENVIRONMENTAL RADIOACTIVITY, COLLECTED IN ITALY (JULY–DECEMBER 1959). Mar. 1960. 79p. (A/AC.82/G/L.369).

Tables of data are presented on environmental fall-out radioactivity collected in Italy by a number of collection stations. (W.L.H.)

24384 CLOR-2

Poland. Biuro Pełnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej. Centralne Laboratorium Ochrony Radiologicznej, Warsaw.
WATER RADIOACTIVITY IN POLAND IN THE PERIOD OF 1957–1959. (Radioaktywność Wód w Polsce w Latach 1957–1959). R. Szepke, M. Bysiek, and D. Grzybowska. Apr. 1960. 31p.

Data pertinent to the monitoring of total beta activity of waters in Poland in the period of Nov. 1958 to Dec. 1959 are presented. Results are given for some measurements of sea water. Collection and preparation of samples, counting, and determination of potassium content are discussed. (W.D.M.)

24385 CRRD-929

Atomic Energy of Canada Ltd., Chalk River, Ont. AUTOMATIC PROCESSING OF RADIATION-EXPOSURE DATA. G. Cowper and P. C. Rowe. July 1960. 7p. (AECL-1052). AECL.

A simple system is described for automatic processing of radiation exposure data from a monitored population of some 2500 workers. Radiation exposures are measured with film dosimeters and entered on IBM cards. (W.D.M.)

24386 DASA-532B

Defense Atomic Support Agency, Washington, D. C. HASP—SPECIAL REPORT ON HIGH ALTITUDE SAMPLING PROGRAM. Albert K. Stebbins, III, ed. June 1, 1960. 244p. OTS.

The results of the HASP program to determine the role played by the stratosphere in the world-wide distribution of radioactive fall-out from nuclear weapons tests are presented. The program has operated since the fall of 1957. The sampling network using U-2 aircraft collected 10^{8} scf of air from 57°S to 71°N up to 70,000 ft. Ashcan data are used for upward extrapolation. IPC Paper 1478 of near 100% efficiency is used. Stratospheric matter sampled is in the 0.01-μ range. Stratospheric inventories of Sr^{90} were calculated for the periods Nov. 1957 to Dec. 1958, Jan. to Aug. 1959, and Sept. to Nov. 1959 to be, respectively, 0.95, 0.81, and 0.7 megacuries. Concentrations were greater in the Northern Hemisphere by a factor of 2 to 3 than in the Southern Hemisphere. The Sr^{90} maximum occurs in the equatorial regions around 90,000 ft and slopes down to around 70,000 ft in the polar regions. Little fractionation is noted in stratospheric debris. Cesium-137 to strontium-90 ratios are 1.8 to 0.5. A semiempirical application of Gaussian diffusion is described which suggests that hot clouds injected in the equatorial stratosphere spread in the North-South direction with mixing coefficients near 5 × 10^{8} cm^{2}/sec. Vertical mixing is slower with coefficients of 4 × 10^{3} and 2 × 10^{4} cm^{2}/sec suggested for tropical and polar regions, respectively. An Injection-Depletion model is offered which indicates that as much as 50% of the material produced in 1-Mt ground-surface burst comes down in local fall-out. Removal from the stratosphere occurs at different rates, depending on altitude and latitude of injection and season of the year. Effective half-residence times of 5, 10, and 20 months, respectively, for polar, low-equatorial and high-equatorial debris are suggested. Surface concentrations of Sr^{90} are displayed as a function of latitude and time. The Northern Hemisphere carries three-fourths of the burden. The maximum burden of Sr^{90} is predicted to occur in 1961; however, concentrations in food have probably reached their maximum value. The radiation hazard from fall-out is summarized. Fall-out has increased the dose man receives from the natural-radiation background by about 2%. (auth)

24387 DASA-1188

Defense Atomic Support Agency, Washington, D. C. RADIOACTIVE FALLOUT FROM NUCLEAR EXPLOSIONS. Edward N. Parker. Mar. 23, 1960. 32p. OTS.

A nontechnical description of the mechanisms of local and world-wide fall-out from nuclear explosions is given. The relative importance of local fall-out in a nuclear war is discussed. The effects upon man of world-wide fall-out from past nuclear testing is discussed. It is pointed out that doses to man from testing are quite small when compared to the natural radiation background. (auth)

24388 DEG-Inf. Ser.-147

United Kingdom Atomic Energy Authority. Development and Engineering Group. Library and Information Dept., Risley, Lancs, England.
BIBLIOGRAPHY ON RADIOACTIVE DECONTAMINATION OF AREAS AND EQUIPMENT. G. I. Maughan, comp. June 15, 1960. 16p. BIS.

A bibliography containing 124 references pertaining to methods and processes of decontamination of radioactive areas and equipment is presented. (C.J.G.)

24389 DEG-Report-156

United Kingdom Atomic Energy Authority. Development and Engineering Group, Dounreay, Caithness, Scotland.
THE ASSAY OF SULPHUR AND TANTALUM DISCS FROM CRITICALITY INCIDENT DOSIMETERS. W. R. Diggle and G. C. Jardine. Apr. 5, 1960. 14p. BIS.

Work on the selection of methods to be used, in the event of a critical incident, for the assay of P^{32} and Ta^{182} is described. Techniques considered are end-window Geiger counting, gamma scintillation counting, and beta scintillation counting. Conclusions and recommendations are presented and procedures are detailed in appendixes. (auth)

24390 HW-66287

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EVALUATION OF RADIOLOGICAL CONDITIONS IN THE VICINITY OF HANFORD, APRIL THROUGH JUNE 1960. R. L. Junkins, E. C. Watson, I. C. Nelson, G. E. Backman, and R. C. Henle. Aug. 5, 1960. 45p. Contract AT(45-1)-1350. OTS.

Results for the second quarter indicate little change in the annual exposure of persons residing in the neighborhood of the Hanford controlled area. The estimated annual exposure of these persons remains at 10 to 15% of that recommended by the National Committee on Radiation Protection. The major part of the estimated annual exposure results from the disposal of reactor-coolant water to the Columbia River. The subsequent consumption of sanitary water derived from the river at downstream communities is the primary mode of exposure. Measurements of radioactive-particle concentrations in the atmosphere indicate that a peak in the concentration occurred in March 1960. The concentrations are considerably less than the concentrations found in the early months of 1959. Vegetation and farm-product sample results remained consistent with those reported for the past two quarters. There is no indication of a peak concentration in these results. (For preceding period see HW-65534.) (auth)

24391 KAPL-A-HP-6
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS MANUAL OF ENVIRONMENTAL MONITORING. M. R. Kennedy. June 30, 1960. 71p. Contract W-31-109-ENG-52. OTS.

The monitoring programs and procedures at KAPL are discussed in detail relative to the meteorology program, environmental air-borne radioactivity monitoring, radiation level monitoring, soil and vegetation monitoring, water monitoring, Mohawk River monitoring, health-physics emergency environmental monitoring, and standards and statistics of the environmental monitoring program. (W.D.M.)

24392 NP-8970
Office of Civil and Defense Mobilization, [Battle Creek, Mich.].
THE FAMILY FALLOUT SHELTER. June 1959. 32p. (MP-15). GPO.

A booklet containing plans for fall-out shelters is presented. Included are five basic plans, one of which can be built by most individuals, while the other four are likely to require the assistance of a construction contractor. (J.R.D.)

24393 NP-9132
Sweden. Försvarets Forskningsanstalt, Stockholm.
THE RADIOACTIVE FALLOUT IN SWEDEN 1957—1958. Gunnar Lindblom. Mar. 1959. 20p.

Measurements were made in Sweden in 1957 and 1958 of the radioactive fall-out in air (at ground level) and in precipitation. The monthly beta activity was measured one month after the end of the sampling period at 10 stations. The 30-yr infinite plane dose was calculated at three of the stations. Airborne radioactivity, total radioactive deposition, and accumulated deposition of Cs^{137} were determined. (M.C.G.)

24394 USNRDL-TR-423
Naval Radiological Defense Lab., San Francisco.
RADIOLOGICAL SAFETY REPORT. HYDRA I AT DAVID TAYLOR MODEL BASIN, WASHINGTON, D. C. W. G. Neall. May 11, 1960. 34p.

Radiological safety was provided at HYDRA I for 31 small-scale underwater detonations incorporating a radioactive tracer, La^{140}. No radiation exposure in excess of the established MPE's occurred and only two instances of personnel contamination took place. Both were quickly and easily decontaminated. Rad-safe monitoring data are summarized. (auth)

24395 JPRS-5027
RESULTS OF THE STUDY OF THE NATURAL RADIOACTIVITY OF THE AIR. I. I. Gusarov. Translated from Gigiena i Sanit. 25, No. 2, 86-8(1960). 7p. OTS.

The natural radioactivity of air was determined by counting the alpha and beta activity of radon aerosol disintegration products precipitated on a membranous filter through which air had been passed. It was found that radioactivity of outside air fluctuates constantly. It was also found that the natural activity of air inside the test buildings exceeds that on the outside, and even higher counts were obtained in the building basement. (J.R.D.)

24396 JPRS-5361
WORKING CONDITIONS IN WORK WITH RADIOACTIVE SUBSTANCES IN THE CONSTRUCTION OF TRUNK PIPELINES AND MEASURES OF IMPROVING THEM. V. A. Kisilenko and M. Ya. Boyarintseva. Translated from Gigiena Truda i Professional. Zabolevaniya 4, No. 3, 49-59(1960). 5p. OTS.

Radioactive isotopes in the construction of trunk pipelines are used mainly for the determination of the quality of welded seams at the pipe junctions. The dangers to the workers who conduct gamma-radiography and to those working around it are discussed. Storage and transportation of the radioactive materials are also considered. (W.L.H.)

24397
A MASS LOADING AND RADIOACTIVITY ANALYZER FOR ATMOSPHERIC PARTICULATES. John S. Nader and Daniel R. Allen (Robert A. Taft Sanitary Engineering Center, Cincinnati). Am. Ind. Hyg. Assoc. J. 21, 300-7(1960) Aug.

A prototype mass loading and radioactivity analyzer for atmospheric particulates was developed. Beta gage technique utilizing carbon-14 is applied to measurement of the thickness of particulate deposits collected on membrane tape. This technique for mass loading analysis is also applicable to paper tape and other media of comparable thickness. The result is expressed in terms of concentration values, i.e., micrograms of particulate per cubic meter of air ($\mu g/m^3$). The proportional counter in the instrument also measures the α- and β-radioactivity content of the dust deposit. The concentration values are in terms of micro-microcuries of activity per cubic meter of air ($\mu\mu c/m^3$). Preliminary indications are that mass loading analysis can be made of particulate concentrations within 100 $\mu g/m^3$, but additional empirical data will be required to assess the effect of combined errors before the limit of sensitivity can be established. Concentrations of natural radioactivity by α detection can be measured as low as 35 $\mu\mu c/m^3$, and artifical radioactivity concentrations by β detection can be measured at 18 $\mu\mu c/m^3$. These values are well within recommended maximum permissible levels in air. Present semi-automatic operation of the instrument permits rapid analyses of a series of samples on tape. Work is currently underway on indicated improvements to increase the sensitivity of the instrument and automatically record the data as the analysis is performed. (auth)

24398
A COMPARISON OF THE COMPOSITION OF REACTOR WASTE SOLUTIONS AND RADIOACTIVE FALLOUT. William J. Lacy (Office of Civil and Defense Mobilization, Battle Creek, Mich.). Am. Ind. Hyg. Assoc. J. 21, 334-9 (1960) Aug.

Both fall-out and power reactor wastes constitute hazards to the population. All radiation is damaging; however, the relative danger will depend on the length of time and level of exposure. Hazards due to radiation and chemical toxicity in a chemical processing plant under conditions of normal operation can be controlled. General radiation levels for radioactive fuel processing equipment can be reduced with proper shields. Ingestion and inhalation of radioactive material, either reactor-produced or from the fall-out of a nuclear detonation, may be detected and controlled. The major biological hazards in the reactor waste after a 30-year accumulation period and a 5-year decay following accumulation are the fission products in the following order: Sr^{90}, Cs^{137}, Ce^{144}, Pr^{144}, and Pm^{147}. All these radionuclides are also formed in a nuclear detonation and are the most hazardous of the long half-life fission products in fall-out, as well as in reactor waste. Chemically, both qualitatively and quantitatively, the accompanying or carrier material usually is a different compound. This complicated, diverse problem involves many fields of science. (auth)

24399

ISODOSE CURVES ABOUT THE BEDS OF PATIENTS CONTAINING INTRACAVITARY RADIUM OR COBALT 60 SOURCES. William F. Barry, Jr. and Ronald Krueger (Duke Univ. Medical Center, Durham, N. C.). Am. J. Roentgenol., Radium Therapy Nuclear Med. 84, 712-14 (1960) Oct.

Recommendations are presented for the protection of personnel working near radioactive patients. (C.H.)

24400

RADIATION ACCIDENTS. Eugene L. Saenger (Univ. of Cincinnati, Coll. of Medicine). Am. J. Roentgenol., Radium Therapy Nuclear Med. 84, 715-28(1960) Oct.

The likelihood of serious radiation accidents is increased due to the rapid growth of nuclear technology in science, industry, and national defense. This paper reviews briefly the possible causes of various types of radiation accidents. Suitable emergency programs are described. The acute radiation syndrome is discussed both from clinical and laboratory aspects. Recent advances in therapy are described. (auth)

24401

REPORT OF THE WORK DONE BY THE GROUP OF HEALTH PHYSICS OF THE CENTRO DI STUDI NUCLEARI DI ISPRA ON THE OCCASION OF THE FRENCH NUCLEAR EXPLOSION IN THE SAHARA. Comit. nazl. ricerche nucleari Notiz. 6, 607-14(1960) June. (In Italian)

The monitoring of the radioactivity of the air, fall-out, surface waters, and foods performed by the Health Physics Group at Ispra is summarized, and the effects of the Sahara explosions on these activities are reported. The interpretation and evaluation of the data obtained are discussed. The hourly concentrations of β activity for Feb. 28 and 29 and Mar. 1 and 2, 1960, and the daily concentration from Feb. 20 to Mar. 5, 1960, are graphed. (J.S.R.)

24402

THE RADIATION DOSE ORIGINATING FROM LUMINOUS DIALS IN THE SWISS. G. Joyet and M. Miller (Universitätsröntgen-institut, Zurich). Experientia 16, 342-6 (1960). (In German)

In 24 persons, (men and women) the gonad dose corresponding to a defined radium charge on the wrist was measured. The β and γ radioactivity of more than 300 watches and clocks was analyzed and the average activities determined. The proportion of men and women in Switzerland wearing luminous watches or having luminous clocks was statistically determined as a function of age. For the whole of the Swiss population, the genetic dose for a generation (30 years) amounts to 100 mr ±25%. (auth)

24403

THE PURIFICATION OF MATERIALS CONTAMINATED BY RADIOACTIVE ISOTOPES. I. Halasz. Magyar Textiltech. 11, No. 6, 239-41(1959). (Translated from Referat. Zhur. Khim. No. 5, 1960, abstract No. 18359)

Formulations are given for a number of detergents used in the purification of materials contaminated by radioactive isotopes. Methods for their application are discussed together with their relative effectiveness. The bibliography lists five titles.

24404

SPRING PEAK OF STRONTIUM-90 FALLOUT. P. K. Kuroda, H. L. Hodges, and L. M. Fry (Univ. of Arkansas, Fayetteville). Science 132, 742-3(1960) Sept. 16.

An increasing trend of Sr^{90} concentration in rain observed at Fayetteville, Ark., after November 1959 indicates that the seasonal and global movements of stratospheric air masses, such as described by Brewer and Dobson, play an important role in causing the spring peaks of the Sr^{90} fall-out. (auth)

24405

ELECTRON DOSIMETRY IN PHANTOMS USING THIN SCINTILLATOR SHEETS. E. Brannen and G. L. Olde (Univ. of Western Ontario, London, Can.). Phys. in Med. Biol. 5, 37-44(1960) July.

The dosimeter described consists of a thin sheet of plastic phosphor placed in a transparent unit density phantom. When irradiated by high-energy electrons, the absorbed dose at points in the phosphor is determined by observing the light emitted by means of a photomultiplier detector system. Depth dose and isodose curves for a 1 mm diameter beam of 1.5 mev electrons are shown. An important feature is the very large build-up effect of absorbed dose near the surface of the phantom. (auth)

24406

INVESTIGATION ON THE INERTIALESS MEASUREMENT OF THE DOSE OUTPUT IN COMMERCIAL X-RAY APPARATUS. Franz Buchmann, Manfred Höfert, and Rainer Röhler (Universität, Munich). Z. angew. Phys. 12, 351-3 (1960) Aug. (In German)

A chamber filled with a scintillation liquid in conjunction with a photoelectron multiplier is suitable for approximate dose-output measurements in the range of x-ray beams from 35 to 100 kv. Since this information is obtained almost inertialess with the help of an electron beam oscillograph, short-beam pulses and fast variations of the dose output can be resolved. The method was used to measure the exposure time and undulations in a diagnostic apparatus. (tr-auth)

24407

Naval Radiological Defense Lab., San Francisco. PRINCIPLES OF RADIATION AND CONTAMINATION CONTROL. R. A. Sulit, E. J. Leahy, and A. L. Baietti. [195?] 162p. $1.00(GPO).

This volume was prepared primarily to supplement the basic radiological data presented in Volumes I and II and to provide more detailed information of the biological effects of radiation, radiation phenomenology, radiation instruments, and health-physics data. (W.L.H.)

24408

American Society for Testing Materials, Philadelphia. ASTM STANDARDS ON METHODS OF ATMOSPHERIC SAMPLING AND ANALYSIS. METHODS OF TESTING RECOMMENDED PRACTICES DEFINITIONS. 1959. 110p. $2.25.

Methods, definitions, and recommended practices developed by the ASTM D-22 Committee are given for sampling and analysis of the atmosphere. In the analysis section, methods are given for determining inorganic fluoride. NO_2, NO, odor, nitrogen oxides in gaseous combustion products, ozone, dust, and SO_2 in the atmosphere. This book should provide a common basis for contaminant analysis and air-pollution control. (D.L.C.)

24409

ACTIVITY LEVELS IN RELATION TO LABORATORY DESIGN AND PRACTICE. A. R. W. Wilson (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). p.147-51 of "Radiation Biology. Proceedings of the Second Australasian Conference on Radiation Biology held at the University, Melbourne, 15-18 December 1958, by the Australian Radiation Society." J. H. Martin, ed. New York, Academic Press Inc. and London, Butterworths Scientific Publications, 1959.

In planning an experiment involving radioactive material, proper consideration must be given to the measures, appropriate to the amount and toxicity of the nucleide involved, which should be adopted as protection against the hazards of ingestion and inhalation. Particular consideration must be given to the type and finish of the laboratory building and the requisite degree of containment of the experiment. It is not possible to formulate rigid rules concerning laboratory design since a number of parameters, which determine the degree of hazard, cannot be evaluated except as a result of experience and then only as lying within a relatively broad range. The activity levels calculated for application at Lucas Heights are presented. It is emphasized that these figures were developed only as a guide to assist in the initial operation of an establishment. They must necessarily be amended in the light of experience and may well prove to be far removed from the limits determined by practice. (B.O.G.)

24410

RADIOISOTOPES AND ENVIRONMENTAL CIRCUMSTANCES: THE INTERNAL RADIOACTIVE CONTAMINATION OF A PACIFIC ISLAND COMMUNITY EXPOSED TO LOCAL FALLOUT. S. H. Cohn, J. S. Robertson, R. A. Conard (Brookhaven National Lab., Upton, N. Y.). p.306-30 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

A unique opportunity for the study of the internal radiation hazard associated with the contamination of an inhabited land mass by local fall-out was afforded when several of the Marshall Islands were accidently contaminated to varying degrees as a consequence of the nuclear detonation of March 1, 1954. Two hundred and thirty-nine Marshallese persons were exposed to levels of γ radiation ranging from 14 r on Utirik to 175 r on Rongelap. The inhabitants of Rongelap and Utirik were also subjected to an acute inhalation and ingestion exposure during the 48-hr period that elapsed prior to evacuation. Initial body burdens of internal emitters were estimated from analysis of urine and also from data obtained on animals simultaneously exposed. These data indicate that the acute hazard from the internal emitters was very small as compared to the concomitant external dose. Medical surveys have been made yearly during the five-year period since the accident in order to follow up the recovery progress of the exposed people. The most comprehensive studies were made at the end of one and two years following the accident. Data were obtained on the residual activity in soil and on the uptake and retention of fall-out material by plants and land and marine animals. These data form the basis for an estimate of the radiation hazard associated with both acute and chronic exposure to local fall-out. During the early period of time following the contaminating accident Sr^{89}, Ba^{140}, I^{131}, the short-lived iodine isotopes, and some of the rare-earth elements contributed the major portion of the internal dose. After the first year, Sr^{90} contributed the greatest dose and was the most critical fission product in regard to internal hazard. Cs^{137} and Zr^{65} were also found in tissues in small amounts. Body burdens of γ-emitting fission products, measured by use of a whole-body counter, agreed closely with estimates made by radiochemical analysis of urine specimens. Transitory changes in blood-cell levels are the only pathological effect which has appeared during the five-year period since the exposure to internally-deposited emitters from fall-out. Tabulated data are included. 29 references. (C.H.)

24411

RADIATION. USE AND CONTROL IN INDUSTRIAL APPLICATION. Charles Wesley Shilling. Modern Monographs in Industrial Medicine 5. New York, Grune & Stratton, 1960. 231p.

The information included is nontechnical and is intended for those who need only a general working knowledge of the subject—for the physician who must handle radiation exposure and injury cases and who must answer questions concerning the mysteries of radiation. Material is included which is not directly related to the usual practice of industrial medicine. A chapter on Genetics is included to provide the latest information on genetic effects of radiation so that questions may be answered intelligently. Other discussions which are intended to keep the physician abreast of the times are: radiation and its source; radiobiology; radiation effects; prevention and treatment of injuries; radiation control; and the use of radioisotopes. (B.O.G.)

24412

IMPROVEMENTS IN OR RELATING TO WASHING DEVICES. David Gordon Stevenson (to United Kingdom Atomic Energy Authority). British Patent 845,991. Aug. 24, 1960.

A washing device for cleaning floors, walls, and similar surfaces is described. The device is comprised of a hollow head with an inlet for cleansing liquid, a skirt of flexible material extending from the head to the surface being cleaned to confine the liquid, and an outlet for removal of soiled water by suction. The head may contain brushes for scouring the surface. (D.L.C.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

24413 MND-SR-1676

Martin Co. Nuclear Div., Baltimore.

STRONTIUM 90 POWER PROJECT. Final Summary Report for October 15, 1958 through February 29, 1960. Mar. 1960. 142p. OTS.

A chemical compound was produced that rendered Sr^{90} insoluble in many media. This compound is $SrTiO_3$, which when tested in 0.1 N acid or base for 750 hr at 120°F showed 5 ppm or less solubility by flame-photometer tests. In demineralized, tap, or sea water, the solubility of a $SrTiO_3$ pellet is extremely low. By tracer experiments with Sr^{90} mixed into the $SrTiO_3$ pellets, it was found that no activity was present in tap water after 2400 hr of testing at 150°F. With natural sea water after 2448 hr at 150°F, the average fraction of $SrTiO_3$ dissolved was 0.0003. At this rate, it would take over 900 yr to dissolve the pellet tested. Additional experiments were conducted with as much as 25% impurities of Ca-Ba without destroying the $SrTiO_3$ ceramic linkage throughout the pellet. Experiments show that insoluble ceramic pellets of $SrTiO_3$ can be clad with a corrosion-resistant metal for increased protection. Such a metal was found in Hastelloy C which, when tested in ocean water for 10 years, showed a corrosion rate of only 0.0001-in. per year. In addition, Hastelloy C does not pit in sea water and can be welded with a Hastelloy C welding rod. Hastelloy C, $\frac{1}{4}$-in.-thick, would resist penetration of sea water for thousands of years. If triple packaging in Hastelloy C were employed, an almost indestructible package of $SrTiO_3$ pellets could be prepared for use in sea water with absolute safety. With lead telluride thermocouples utilized within the package, the assembled unit could produce usable amounts of electrical power. Conceptual designs were prepared for two 100-watt electrical generators for use on land or in sea water, and a 5-watt electrical generator for use with an automatic weather station. Models of both the 5- and 100-watt generators were prepared. Environmental tests of thermoelectric elements were conducted while operating at design temperatures and being irradiated by high-energy γ rays. Results indicated satisfactory performance. Vibration and shock tests were also performed with thermoelectric elements. One-half-in.-dia. elements successfully passed all vibration and shock tests. The 0.187-in.-dia. elements had difficulty with the 15-g loadings. However, it is felt that a revised design may pass the more stringent tests. Power production during vibration was slightly lowered, but after testing, the power generation returned to normal. (For preceding period see MND-SR-1675.) (auth)

24414 NP-8976
Massachusetts Inst. of Tech., Cambridge. Div. of Industrial Cooperation.
STUDIES OF BEEF IRRADIATION FLAVOR USING A CONCURRENT RADIATION-DISTILLATION TECHNIQUE. Report No. 2 (Progress) [for] Period: August 1, 1959–October 31, 1959. B. E. Proctor. 26p. Project No. 7-84-01-002. Contract DA-19-129-QM-1374.

It has been shown on the basis of comparison of gas chromatographic retention times on three columns that methional (β-methylthiopropionaldehyde) is one of the components of the off-flavor produced in raw ground beef by means of concurrent radiation-distillation at 5 megarad. One of the structural isomers of methional and its lower homolog, α-methylthioacetaldehyde, have been synthesized and proved not to be present in a typically odorous isolate obtained from the meat distillate. The second structural isomer of methional is believed to have been prepared. Its further purification is required before rigorous proof of its identity can be made. (auth)

24415 NP-8980
Michigan. Univ., Ann Arbor. Medical School.
DETERMINATION OF RADIATION STERILIZATION DOSE FOR CANNED MEAT. Report No. 13 (Final) [for] August 1, 1957–November 30, 1959. L. L. Kempe and J. T. Graikoski. Nov. 1959. 123p. Project No. 7-84-01-002. Contract DA-19-129-qm-964.

Canned ground beef containing 5,000,000 C. botulinum spores per gram was sterilized with between 3.80 and 3.85 megarad of γ rays. Higher spore inocula would probably require higher sterilization dosages. Botulinus toxin was regularly found in irradiation-sterilized and incubated cans of ground beef inoculated with 2,670,000 or more C. botulinum 62A spores per gram. The lethality of γ rays for C. botulinum spores was found to be slightly dependent upon both the temperature during irradiation and the intensity of the radiation field. Canned peas, inoculated with C. botulinum spores, were more easily sterilized with combined irradiation-heat processing than by either form of energy alone. (auth)

24416 NP-9033
Colorado. Univ., Boulder.
THE NUTRITIONAL ADEQUACY AND PROBABLE TOXICITY OF FOODS PRESERVED BY IONIZING RADIATIONS. Progress Report No. 13 [for] Period: September 15, 1959 to March 15, 1960. Merrill S. Read, Howerde E. Sauberlich, William S. Worth, Harold M. Trabosh, and Richard S. Harding. 15p. Contract Da-40-007-MD-549.

Liver enzyme studies in animals fed Johnson type diets show that cytochrome oxidase activity is increased in animals fed the K-deficient irradiated diet. Supplementation with menadione returns these to normal. A gradient evaluation of the amount of vitamin K_1 required by the rat when fed a diet of irradiated beef was performed. The rat's minimum requirement for normal blood coagulation was 5.24 μg vitamin K_1 per rat per day. Raw nonirradiated pork induced hemorrhage when fed to the rat. Rats were fed a diet containing bile acids and were orally administered gradient levels of vitamin K_3. The minimum level of K_3 required for normal blood coagulation was 2 μg per rat per day which is 50% less than that required when bile acids were not fed. Whole and skim milk was studied after direct irradiation and after the irradiation-distillation method. The irradiation-distillation technique seems to result in less protein alteration as exhibited by allergenicity and electrophoretic studies but results in a greater loss of methionine than the direct irradiation technique. The degree of protein alteration is dependent upon the concentration of the milk, the butterfat content, and the method of irradiation. (auth)

24417 NP-9049
Illinois. Univ., Urbana.
ON THE NUTRITIVE VALUE OF THE MAJOR NUTRIENTS OF IRRADIATED FOODS AND APPRAISAL OF THE TOXICITY OF IRRADIATED FOODS. Progress Report No. 17 for Period September 2, 1959–March 15, 1960. V. Chalam Metta, M. S. Mameesh, P. B. Rama Rao, and B. Connor Johnson. 15p. Contract DA-49-007-MD-544.

Feeding of irradiated beef induces vitamin K deficiency in growing male, but not female, rats. Since the latter seem to require very little dietary vitamin K, even under conditions of coprophagy prevention, susceptibility to K deficiency appears to be a primary sex difference in the rat. Non-coprophagic female rats fed a K-free synthetic diet conceived, but none of the litters born survived beyond three days. Studies on the nature of the hemorrhagic syndrome encountered in weanling male rats fed irradiated beef indicated that the syndrome was caused by a lack of vitamin K and not by any hypoprothrombinemic factor in irradiated beef. This conclusion was based on (1) when the level of irradiated beef in the diet was increased, the incidence and severity of hemorrhages decreased and (2) the vitamin K requirement of coprophagy-prevented rats fed a diet high in irradiated beef was found to be the same as that reported for similar rats fed a purified diet. Irradiated beef (2.79 or 5.58 megarad) results in loss of vitamin K activity as measured by the chick assay. Nonirradiated beef has 33 γ K_1/100 g (on a dry basis); irradiation results in a 50% loss of vitamin K activity. Menadione (K_3) and vitamin K_1 when fed orally are equally effective in restoring normal plasma prothrombin time of rats fed irradiated beef diets. (auth)

24418 NP-9074
Quartermaster Food and Container Inst. for the Armed Forces, Chicago.
DETERMINATION OF THE DIFFERENCES IN RESISTANCE OF CLOSTRIDIUM BOTULINUM TYPES AND STRAINS TO IONIZING RADIATION. Report No. 7 (Progress) [for] October 1–December 31, 1959. Abe Anellis. 4p. Project No. 7-84-01-002. (QMF & CI-33-59).

Ten strains of Cl. botulinum spores were screened for resistance to 1.4 megarad γ rays in phosphate buffer at pH 7.0. Strain 36A survived in 6 of 10 replicate tubes and appears to be the most radioresistant of 58 strains tested. Strain 37A was viable in one of 10 replicate tubes. The remaining strains were killed by 1.4 megarad. A toxigenic variant of strain 12885A was somewhat more radioresistant than the nontoxigenic variant. (auth)

24419 NP-9075
Quartermaster Food and Container Inst., Chicago.
A STUDY OF THE FLAVOR CHANGES INDUCED BY IRRADIATION OF MEAT. Report No. 6 (Progress) for Period: October 1, 1959—December 31, 1959. P. A. Hedin. 15p. Project No. 7-84-01-002. (QMF&CI-37-59).

Additional information is given concerning the nature of the "irradiated" or "wet dog" odor produced from a water-soluble cooked-beef protein fraction. Ammonium sulfate fractions from this extract were found to be different from similar fractions prepared from cold-water and cold-saline extracts which gave "wet chicken feather" and "raw irradiated beef" odors. Chemical and physical studies of the cooked-extract fraction producing the irradiated odor indicated that it was similar to gelatin and contained carbohydrate. (auth)

24420 NP-9076
Oregon. Agricultural Experiment Station, Corvallis.
INCREASING THE ACCEPTANCE OF IRRADIATED MEAT AND MEAT PRODUCTS BY SELECTED TREATMENTS, BEFORE, DURING AND FOLLOWING IRRADIATION. Report No. 13 (Progress) (Revised) for July 27, 1959—October 26, 1959. H. W. Schultz. 12p. Project No. 7-84-01-002. Contract DA19-129-QM-836.

Meat was infused with salt and the water-holding capacity determined. The effect of age after slaughter on tenderness of enzyme-inactivated beef was determined. The combined effect of salt, grade of beef, and irradiation on the water-holding capacity and tenderness was determined in enzyme-inactivated New York cuts. In general, salt and irradiation increase the water-holding capacity and tenderness while the grades reacted differently. (auth)

24421 NP-9077
Oregon. Agricultural Experiment Station, Corvallis and Oregon State Coll., Corvallis. [School of Agriculture].
INCREASING THE ACCEPTANCE OF IRRADIATED MEAT AND MEAT PRODUCTS BY SELECTED TREATMENTS, BEFORE, DURING AND FOLLOWING IRRADIATION. Report No. 14 (Progress) [for] Period: October 27, 1959 to January 26, 1960. H. W. Schultz. 18p. Project No. 7-84-01-002. Contract DA19-129-QM-836.

Irradiated pork should be preheated to 160 to 170°F in order to prevent increases in total soluble nitrogen, trichloracetic acid nitrogen, amino nitrogen, and free exudate and to retard undesirable changes in certain sensory qualities due to long-term storage. Beef steaks heated to 140, 150, and 160°F internal temperature as an irradiation dose of 4.8 megarad was accumulated were evaluated by sensory panel (hedonic) after 0, 3, and 6 months storage at room temperature. Grilled steaks irradiated in continually changing atmosphere of air, CO_2, and N_2 revealed no difference in flavor of beef. Irradiation of beef steaks in a "static" atmosphere of these same gases produced no difference in flavor. (auth)

24422 NP-9078
Michigan. Univ., Ann Arbor. Research Inst.
DETERMINATION OF RADIATION STERILIZATION DOSE FOR CANNED MEAT. Report No. 12 (Progress) [for] Period: August 1, 1959 to November 30, 1959. Lloyd L. Kempe. 5p. Project No. 7-84-01-002. Contract DA-19-129-qm-964. (UMRI-2681-12-P).

The previous finding of botulinus toxin in unswollen cans of irradiation-sterilized meat taken from incubated storage was verified. The additional incubation period of six months had no detectable effect on the presence of toxin in these samples. (auth)

24423 NP-9080
California. Univ., Davis.
STUDIES ON PHYSICAL AND CHEMICAL MODIFICATION OF PROTEINS FOR THE PREVENTION OF IRRADIATION OFF-FLAVORS IN MEAT. Report No. 5 (Progress) [for] August 15, 1959—November 14, 1959. A. L. Tappel. 5p. Project No. 7-84-01-002. Contract DA-19-129-QM-1172.

Reported are the nitrogen fractionation and carbonyl content on irradiated cytochrome c and hemoglobin solutions to evaluate the radiation damage. (auth)

24424 NP-9082
National Canners Assn. Washington Research Lab., Washington, D. C.
STUDY OF THE DESTRUCTION OF FOOD POISONING ORGANISMS IN CANNED FOODS SUBJECTED TO IONIZING RADIATIONS. Report No. 21 (Progress) for September 10, 1959 to December 9, 1959. C. W. Bohrer. 4p. Project No. 7-84-01-002. Contract DA-19-129-QM-445.

The inoculated pack studies using Clostridium botulinum in five food products to determine radiation sterilizing doses are completed. Incubation results have not changed since the June report. All five products were tested for toxin production in flat cans with negative results. Counts after one year of incubation on the three remaining products irradiated at room temperature were made. These counts are given. (auth)

24425 NP-9083
Utah State Univ., Logan.
STUDIES ON RADIATION PRESERVATION OF FRUIT AND VEGETABLE PRODUCTS. Report No. 3 (Final) for December 1, 1958—November 30, 1959. D. K. Salunkhe. 63p. Project No. 7-84-01-002. Contract DA-19-129-QM-1345.

Progress is reported on effects of radiation dose, rate, and temperature on the preference, microbiological activity, shelf life, and physiochemical changes in fruits and vegetables. (auth)

24426 NP-9086
American Can Co., Barrington, Ill.
RESEARCH STUDY ON CAN ENAMELS AS PART OF THE RADIATION PRESERVATION OF FOODS PROGRAM. Report No. 9 (Progress) [for] April 29, 1959—October 28, 1959. G. B. Pratt. 17p. Project No. 7-84-01-002. Contract DA19-129-QM-968.

Can enamels have been found satisfactory for irradiated cherries, chili con carne, beef, and codfish after 1 yr at 98°F. Extraction studies have commenced on irradiated enamels. (auth)

24427 NP-9087
Oklahoma State Univ., Stillwater.
DETERMINING THE EFFECT OF ANIMAL MATURITY AND FAT DISTRIBUTION ON THE QUALITY OF IRRADIATED BEEF. Report No. 6 (Progress) for June 6, 1959—December 5, 1959. R. L. Henrickson. 9p. Project No. 7-84-01-002. Contract DA-19-129-QM-1033.

Ground beef from animals 6, 12, and 24 months old was evaluated for variation in the irradiation flavor. The eating preference for ground meat from animals of different maturity varied only slightly. There was a preference shown for meat from animals 12 months old. The eating desirability was significantly influenced by the level of irradiation, storage temperature, and storage period. The fat content of ground beef has some influence on the eating preference of the meat. The difference, however, was not as great as one might expect. Ground meat with a small amount of fat (8%) was preferred to ground meat with 28.5% fat. The maturity of the animal from which the meat was taken influenced to some extent its desirability. Eating preference data do not indicate significant differences in the flavor among steaks from different animals of similar breeding. The intensity of the irradiation flavor did seem to vary. Evidence is presented which clearly indicates that the cultures isolated from steak samples were not radiation resistant. (auth)

24428 NP-9090
Michigan State Univ., East Lansing.
DIP COAT PACKAGING OF IRRADIATED FOODS. Report No. 9 (Progress) [for] September 15, 1959–November 14, 1959. L. J. Bratzler. 4p. Project No. O.I. 6169. Contract DA 19-129-QM-1195.

Progress is reported on 9- and 12-month 0°F storage of roasts of chicken and roasts of pork coated with three plastic materials. Very little difference was noted in TBA values, acceptability scores, and weight changes when compared with previous 6- and 9-month results. Cornish game hens and roasts of pork are ready for irradiation and subsequent storage. (auth)

24429 NP-9092
Florida State Univ., Tallahassee.
STABILIZING IRRADIATED MEATS AGAINST OXIDATIVE CHANGES DURING STORAGE. Report No. 5 (Progress) for October 1, 1959–December 31, 1959. Betty M. Watts. 12p. Project No. 7-84-01-002. Contract DA19-129-QM-1321.

Heme catalysis of unsaturated fatty acids is explored and a theory proposed. Neither antioxidant dips, cover solutions, nor carotene improved the odor of irradiated cooked beef. (auth)

24430 NP-9093
Purdue Research Foundation, Lafayette, Ind.
DEVELOPMENT OF IRRADIATION STERILIZED MEAT PRODUCTS. Report No. 3 (Progress) (Revised) for July 16, 1959–October 15, 1959. W. J. Stadelman. 8p. Project No. 7-84-01-002. Contract DA 19-129-QM-1364.

Progress is reported relative to improving tenderness and color of irradiated poultry meat. More work is necessary to have a method for treating poultry meat prior to irradiation at 5 megarad to eliminate development of off-color and toughness. (auth)

24431 NP-9094
Oregon. Agricultural Experiment Station, Corvallis and Oregon State Coll., Corvallis. [School of Agriculture].
DEVELOPMENT OF IRRADIATION STERILIZED SHELF STABLE FISH AND SEAFOOD PRODUCTS. Report No. 4 (Progress) [for] October 12, 1959–January 11, 1960. H. W. Schultz. 12p. Project No. 7-84-01-002. Contract DA19-129-QM-1356.

Precooked breaded fish sticks, irradiated at 0, 1.5, 3.0, and 4.5×10^6 megarad were evaluated by a large student taste panel and a trained staff taste panel. Taste panel evaluations of storage tests will be conducted at a later date. French-fried shrimp, 0 Laboratory, 0 Shipped, 1.5, 3.0, and 4.5×10^6 megarad, were evaluated by a large student taste panel and a small staff taste panel. Precooked breaded codfish cakes, containing an antioxidant, were irradiated at 0, 1.5, 3.0, and 4.5×10^6 megarad; cakes without an antioxidant were irradiated at 4.5×10^6 megarad. These samples were evaluated by a large student taste panel and a trained staff taste panel. Storage tests are in progress. Enzyme inactivation studies were made on ground codfish cakes by preheating to internal temperatures of 150, 160, and 170°F and holding for 15, 60, 180, and 300 sec prior to irradiation at 4.5×10^6 megarad. Samples were stored for 0, 15, and 30 days at 0 and 100°F and analyzed for amino nitrogen. (auth)

24432 NP-9096
Quaker Oats Co. Research Labs., Barrington, Ill.
USE OF VARIOUS AMOUNTS OF RADIATION AND HEAT PROCESSING IN THE PRESERVATION OF CANNED FOODS. Report No. 13 (Progress) [for] July 1, 1959–September 30, 1959. E. F. Caldwell. 11p. Project No. 7-81-01-002. Contract QMR&E (Natick) No. 15 (Agreement).

The extent of electron penetration at various depths as measured by Co glass dosimeters and the survival of thermophilic bacterial spores were compared by irradiation of six 0.5-cm agar layers containing both Co glass dosimeters and spores of *Bacillus stearothermophilus*. A high degree of correlation between dose received and per cent survival was observed at dose levels from 100,000 to 2 million rads. At lower doses or at agar depths greater than 1.5 cm results were more erratic. Bacteria survival and glass dosimeter results from electrons were compared with those obtained from gamma rays from a spent fuel rod source calibrated by ferrous dosimetry. (auth)

24433 NP-9097
Reliable Packing Co., Chicago.
EFFECT OF IRRADIATION ON CANNED PORK PRODUCTS. Report No. 6 (Progress) for July 11, 1959–January 11, 1960. John E. Thompson. 4p. Project No. 7-84-01-002. Contract QMR&E (Natick) No. 50 (Agreement).

Experiments evaluating the effect of irradiation on heavily smoked bacon were performed. An irradiation dose of 4.5×10^6 rad was used on canned bacon smoked 12 to 24 hr. The results indicate that the smoked flavor was not destroyed by irradiation; however, double smoke treatment did not improve the organoleptic qualities of irradiated bacon. Storage temperature did not appear to affect product quality, except for the amount of fat released from the product during storage. (auth)

24434 NP-9099
National Dairy Products Corp. Research and Development Div., Glenview, Ill.
EFFECTS OF IRRADIATION ON FRESH FRUITS AND VEGETABLES AND DAIRY PRODUCTS. Report No. 2 (Progress) [for] August 1, 1959–October 31, 1959. W. L. Hock. 4p. Project No. 7-84-01-002. Contract QMR&E (Natick) No. 112.

In a preliminary investigation, dried whey powder with low initial numbers of bacteria required the same dose as did dried whey powder with high initial numbers of bacteria to reduce the bacterial count to less than 10 per gram. Six lots of dried whey powder (bacterial counts ranging from 1400 to 383,000 per gram) were irradiated at various dose levels from 0 to 3.2 megarad. The dosage required to lower the count to less than 10 per gram for all samples fell in the range of approximately 0.8 to 1.6 megarad. (auth)

24435 NP-9100
Dubuque Packing Co., Iowa.
UTILIZATION OF RADIATION FOR INCREASED SHELF LIFE OF FRESH AND CANNED MEATS. Report No. 1 (Progress) [for] May 2, 1959–November 2, 1959. Don Manders. 5p. Project No. 7-84-01-002. Contract QMR&E (NATICK) No. 120.

It appears that low-level radiation followed by thermal processing at a pasteurizing level can produce a canned ham that can withstand an extended period of incubation without the development of anaerobic bacteria. Moreover, at the 100,000-rad level of radiation, the irradiated and heat-processed ham had a significantly higher panel acceptance than the corresponding heat-processed control after both had been held at room temperature for 30 days.

Shrink and texture disadvantages, which have always been present in canned hams made sterile by high-temperature heat processing, were not found in any of the irradiated hams. (auth)

24436 NP-9101
California. Univ., Davis.
RADIATION PRESERVATION OF FRESH STRAWBERRIES AND GRAPES. Report No. 2 (Progress) for March 5, 1959–December 31, 1959. E. C. Maxie and K. E. Nelson. 13p. Project No. 7-84-01-022. Contract QMR&E (Natick) No. 115 (Agreement).

Royal apricots are softened markedly at doses of 200,000 rads and greater. This appears to be a radiation effect on texture for the time of the onset of the climacteric was not altered. The ripening of Bartlett pears was inhibited by doses of 100,000 and 200,000 rads. Similated transit tests with Shasta strawberries indicate that irradiation at doses of 100,000 and 200,000 rads with an 8-Mev electron beam from a linear accelerator had no significant ill effects on the texture of the berries. Taste panel evaluations indicate that acceptance of Shasta strawberries is not adversely effected by irradiation at doses up to 200,000 rads. (auth)

24437 NP-9210
Cornell Univ., Ithaca, N. Y.
EFFECT OF IONIZED RADIATION ON THE NUTRITIVE VALUE OF FOOD (BEEF) AS DETERMINED BY GROWTH, REPRODUCTION, AND LACTATION STUDIES WITH DOGS. Final Report, Part I. C. M. McCay and G. L. Rumsey. Mar. 15, 1960. 8p. Contract DA-49-007-MD-600.

The effect of beta radiation on the nutritive value of beef was studied using 18 female beagle dogs. It was concluded from hematological and growth data that there were no detrimental effects. Lowered reproduction might possibly be one harmful effect, but vitamin deficiency was suspected and this factor should be studied further. (T.R.H.)

24438 NP-9211
Cornell Univ., Ithaca, N. Y.
EFFECT OF IONIZED RADIATION ON THE NUTRITIVE VALUE OF FOOD (CORN) AS DETERMINED BY GROWTH, REPRODUCTION, AND LACTATION STUDIES WITH DOGS. Final Report, Part I. C. M. McCay and G. L. Rumsey. Mar. 15, 1960. 7p. Contract DA-49-007-MD-600.

The effects of gamma-irradiated corn on 14 beagle dogs were studied. The data collected included hematological findings, x-ray photos of bones, growth, and reproduction. No deviations from normal were found, indicating irradiated corn as a satisfactory food in the diet of the dog. (T.R.H.)

24439 TID-6390
Tracerlab, Inc., Waltham, Mass.
USE OF RADIOISOTOPES AS A SOURCE OF X-RAYS TO DEVELOP A RAYLEIGH SCATTERING METHOD FOR THE ANALYSIS OF HIGH Z ATOMS IN A LOW Z MEDIA. Quarterly Progress Report for the Period April 15 to July 15, 1960. 24p. Contract AT(30-1)-2538. OTS.

The determination of total fuel loading (i.e., U concentration) in fuel elements was selected as application for the Rayleigh scattering gage. When using a Kr^{85} clathrate + U_3O_8 mixture as the x-ray source, 235,000 counts/min/sq in. of fuel element surface were obtained in the optimum signal channel, 98 to 114 kev in bandwidth. This yielded better than 0.25% deviation in 1 min. (See also TID-6104.) (C.J.G.)

24440 TID-6553
Goodyear Tire and Rubber Co., Akron, Ohio.
ISOTOPIC METHOD FOR AGE DETERMINATIONS OF INDUSTRIAL PRODUCTS. Quarterly Progress Report [for] April–June 1960. T. C. Gregson and L. B. Bangs. 13p. Contract AT(11-1)-719. OTS.

Initiation of product-application studies is reported. Data obtained during accelerated age measurements of gasoline dated with a C^{14} (stearic acid)/P^{32} (tricresyl phosphate) pair are tabulated. Samples of dated gasoline were periodically withdrawn for measurement of time lapse between preparation and counting dates. The gasoline-dating work was hampered by malfunctioning of the liquid scintillation spectrometer; however, these data indicate that the method is adequate. (J.R.D.)

24441
RADIATION TECHNIQUES FOR PROCESS MEASUREMENTS. Alfred H. McKinney [(E. I. Du Pont de Nemours & Co., Wilmington, Del.)]. Chem. Eng. Progr. 56, 37-8(1960) Sept.

Gamma-gaging techniques for process measurements such as liquid levels, density, and flow rates are discussed. The types of detectors most commonly used are Geiger tubes and ion chambers. The Geiger tube and its associated equipment is less expensive and will operate at low levels of radiation, but it is unsatisfactory for reliable measurements of small changes in radiation. The selection of a γ source suitable for the application is discussed. To measure liquid level in a tank two feet in diameter or larger, a Co^{60}, radium, or other high-energy source would be adequate and less expensive than any other source. For small columns, or density measurements, a less energetic source is more suitable. Scattered radiation is largely eliminated by collimators. Various geometrical arrangements which give different responses to liquid and solid level changes are included. (M.C.G.)

24442
THE APPLICATION OF IRRADIATION IN INDUSTRY. M. C. Crowley-Milling (Associated Electrical Industries, Ltd., Manchester, Eng.). J. Brit. Nuclear Energy Conf. 5, 207-21(1960) July.

A survey of the types of radiation shows that only γ rays and high-speed electrons are worth consideration for industrial radiation. Possible applications and methods of producing such radiation are discussed. The problems of the introduction of irradiation into industry are examined, and the methods of applying electron irradiation are explained. A typical installation is described, and the economic aspects are considered. (auth)

24443
THE APPLICATION OF RADIOACTIVE ISOTOPES IN PROCESS ENGINEERING. Konrad Sagel (Metall-Laboratoriums der Metallgesellschaft AG, Frankfurt am Main). VDI Zeitschrift 102, No. 23, 1095-1102(1960) Aug. 11. (In German)

Radioactive isotopes are being employed to an increasing extent for process engineering applications. Typical uses are for radiation sources in radiochemistry and radiography, gaging the thickness of sheet metal and paper, measuring liquid level of containers and the density of liquids, checking the volume of suspended matter and mixtures, and locating leaks in pipes. As tracers, isotopes are also used for controlling separating and blending processes; checking filters and precipitators; examining reaction mechanisms; determining reaction kinetic values through exchange reactions; measuring the specific surface of powders; investigating friction, corrosion, and diffusion; and for various techniques used in radiochromatography. (auth)

24444
RADIOLOGICZNA KONTROLA PRODUKCJI. (Radiological

Control of Production). Maciej Radwan and Andrzej Prądzyński. Warsaw, Państwowe Wydawnictwa Techniczne, 1957. 314p.

Chapters are included on origin of x rays and γ rays; properties of x rays and γ rays; interaction with matter; industrial x-ray apparatus and components; theoretical foundations of radiological investigation; radiography; fluoroscopy and fluorography; ionometric methods of metallic inspection; radiographic inspection of welds; radiographic inspection of casts; particular applications of radiological inspection; inspection of metals with γ rays; and principles of safety and health in the application of x rays and γ rays. (TTT)

24445

United States. Congress. Joint Committee on Atomic Energy.
NATIONAL FOOD IRRADIATION RESEARCH PROGRAM. HEARINGS BEFORE THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, SECOND SESSION, JANUARY 14 AND 15, 1960. PART I. 671p. GPO.

The Joint Committee on Atomic Energy of the Congress of the United States met on January 14 and 15, 1960, for hearings on the status of the national food irradiation research program. The history of developments in the program is reviewed. It was pointed out that in 1953 the AEC passed on to the Department of the Army the responsibility for research and development in the field of food irradiation. The objective of the program was to provide the Army with simplified foods in the best possible form. It was felt that this might be accomplished by the radiation processing of foods, particularily of meats. Accomplishments of the program are reviewed. In 1959 a critical review of the Army's food irradiation program, the potential economic and logistical advantages, and the possible health hazards associated with the extended use of irradiated foods by humans resulted in the decision by the Army to indefinitely suspend plans for the construction of a proposed Army Food Irradiation Center and to orient the curtailed Army program toward fundamental studies in the field of food irradiation. Data accumulated as a result of the Army food irradiation program are summarized. Food irradiation facility designs are discussed. The desirability of the development of facilities for studies on low-dose radiation processing of foods is stressed. Pertinent reports and communications are appended. (C.H.)

24446

United States. Congress. Joint Committee on Atomic Energy.
NATIONAL FOOD IRRADIATION RESEARCH PROGRAM. HEARING BEFORE THE SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, SECOND SESSION, MARCH 31, 1960. PART 2. 228p. GPO.

The Subcommittee on Research and Development of the Joint Committee on Atomic Energy of the Congress of the United States met on March 31, 1960, for hearings on the status of the national food irradiation research program. This hearing was a continuation of hearings held on January 14 and 15, before the full committee on the status of the Army and civilian food irradiation programs. Topics discussed include the revised Army program of radiation processing of foods, the program of the AEC, and the recommendations of the Interdepartmental Committee on Radiation Preservation of Foods. Accomplishments of the Army's program of high-dose radiation-sterilization of foods were reviewed. It was pointed out that the Department of the Army has maintained an active research program from 1954 to the present and plans to continue to study economic and logistic advantages of using irradiated foods in the military supply system. Emphasis will be placed on the high-dose processing of meats. The AEC program will be directed toward the study of low-dose radiation processing of perishable foods to extend their shelf life. Initial emphasis will be placed on fruit and fish. It was pointed out that low-dose radiation processing promises to be the most immediately useful civilian application of ionizing radiation for food processing purposes. Applications of radiation processing in retarding ripening and extending the storage life of strawberries, peaches, and other fruits are discussed. Applications in the processing of fish are reviewed. The design and feasibility of construction were discussed for several mobile irradiators which may be moved to different areas as foods are harvested. Schematic sketches of several irradiator designs are included. It was pointed out that these low-dose irradiators will also be applicable in the elimination of insects from such foods as flour, beans, and sugarcane. It was proposed that the research program be continued to provide information on the quality, wholesomeness, and safety of foods processed by low-dose radiation. Pertinent correspondence, statements, technical reports, and bibliographies are appended. (C.H.)

24447

American Society for Testing Materials, Philadelphia.
SYMPOSIUM ON RADIOISOTOPES IN METALS ANALYSIS AND TESTING. Presented at the Sixty-second Annual Meeting, Atlantic City, N. J., June 22, 1959. ASTM Special Technical Publication No. 261. 66p. $2.75.

Eight papers are included. Separate abstracts have been prepared for each paper. (B.O.G.)

24448

TRAINING INDUSTRIAL PERSONNEL IN RADIOISOTOPE UTILIZATION. John P. Danforth (General Motors Corp., Warren, Mich.). p.52-61 of "Symposium on Radioisotopes in Metals Analysis and Testing. Presented at the Sixty-second Annual Meeting, Atlantic City, N. J., 1959. ASTM Special Technical Publication No. 261." Philadelphia, American Society for Testing Materials, 1960.

The General Motors Research Laboratories, in conjunction with the General Motors Institute, has conducted its "Radioisotopes In Industry" Training Program since May 1957. This technical training activity encompasses, in an intensive ten-week period, subjects ranging from simple atomic physics to highly technical neutron activation techniques. Subject matter coverage is designed to give the participants a broad understanding of the basic physical principles involved in the measurement and manipulation of radioactivity. The curriculum is based upon the premise that each trainee should acquire sufficient knowledge regarding radioisotopes to be capable of effectively organizing and conducting a radioisotope program for his organization with a minimum of further assistance. In order to utilize presentation time to the fullest advantage, all of the course material was carefully organized and programmed along the lines used in General Motors technical training courses. At the request of the U. S. AEC Office of Isotope Development, the training program outline is being prepared in book form for public release. In conjunction with this release, to further promote radioisotope utilization by American industry, the AEC is currently planning and sponsoring courses involving the industrial application of radioisotopes. These courses will have the same general design and intent as the one just described and will be available to technical people from industry at large. (auth)

24449

INVISIBLE MARKING OF MATERIALS. (to United Kingdom Atomic Energy Authority). British Patent 850,161. Sept. 28, 1960.

A method is given for marking materials or writing messages with radioactive paint or ink invisible to the eye but traceable by radiation detectors or photographic emulsions. Radioisotopes applicable to such use are given together with three examples of the application of this method. (D.L.C.)

ISOTOPE SEPARATION

24450

HEAVY WATER STAKES LURE NEW ENTRY. Chem. Eng. 67, No. 19, 92-4(1960) Sept. 19.

A description is given of a process for producing heavy water at a cost of $21.50/lb, including operating costs and 15% capital charges. This cost is compared to the AEC selling price of $28/lb. The process is based on the principle that deuterium will transfer from H_2 to ammonia at sub-zero temperatures, but at 212°F will leave the ammonia molecule in preference for hydrogen. The deuterium is extracted catalytically from NH_3 synthesis (75% H_2, 25% N_2) at −40°F by liquid ammonia. The process yields 99.8% D_2O. The ammonia is returned to the production cycle enriched threefold in N^{15}. Future production costs might be reduced if the demand for the N^{15} isotope develops. (B.O.G.)

24451

McCABE-THIELE DIAGRAM FOR THE IDEAL CASCADE. Alfred J. Surowiec. Ind. Eng. Chem. 52, 789(1960) Sept.

A McCabe-Thiele diagram is constructed for the ideal cascade used in the theory of isotopic separations by distillation, considering only the enriching section. The treatment shows that the ideal cascade requires twice the minimum number of stages for any separation and twice the minimum downflow at all interstage points. (D.L.C.)

24452

HEAVY WATER PRODUCTION IN SWEDEN. Bengt J. Eriksson. Nuclear Eng. 5, 409-12(1960) Sept.

The possibilities for the production of heavy water were investigated in Sweden by ASEA. During 1955 and 1956, a small pilot plant was erected and operated by the use of a method involving isotope exchange between hydrogen sulfide and water. In early 1959 a larger pilot plant was put into operation. A plant study was made with a design capacity of 40 tons of heavy water per 8,000 hr. Flow diagrams, a description of the process, cost estimates, and manufacturing costs are included. (M.C.G.)

24453

IMPROVEMENTS IN OR RELATING TO SEPARATION OF ISOTOPES IN ELECTRIC AND MAGNETIC FIELDS. Joseph Slepian. British Patent 837,186. June 9, 1960.

An electric discharge apparatus for isotope separation is comprised of an arc chamber with a magnetic field parallel to the arc, expander electrodes with their electric field perpendicular to the arc and having their separation at a minimum near the arc and diverging thereafter, and electrically connected isotope collectors slatted in such a way that isotope ions are deposited on the slats but the neutral molecules pass through the spaces between slats. (D.L.C.)

24454

METHOD OF ISOTOPE CONCENTRATION. Jerome Saul Spevack. British Patent 845,501. Aug. 24, 1960.

A method of isotope concentration by exchange between two separable phases at different temperatures is described with special reference to D_2 concentration by H_2O-H_2S exchange. Four configurations of a dual-temperature exchange apparatus for the H_2O-H_2S exchange are given using counter-current flow, bubble-cap towers, and spray injectors to contact the two phases; one is capable of producing ~5 tons/month of 2% D_2O in water from inputs of 1350 gpm H_2O and 532,600 cfm H_2S. The extension of the techniques to other isotope separations is discussed. (D.L.C.)

MATHEMATICS AND COMPUTERS

24455 AERE-M-709

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

COMPARISON DEBUG—A ROUTINE FOR MERCURY. A. R. Curtis. July 1960. 6p. BIS.

A powerful method of program debugging is to continually record the present contents of assigned parts of the store and at the same time to print out any changes in those contents since they were last recorded. It is also useful to be able to print an indication of the point reached in the program and the contents of selected arithmetic registers. A routine is described which provides these facilities, selection being by handswitch setting. (W.D.M.)

24456 ANL-6195

Argonne National Lab., Ill.

APPLIED MATHEMATICS DIVISION SUMMARY REPORT FOR JULY 1, 1959 THROUGH JUNE 30, 1960. 64p. Contract W-31-109-eng-38. OTS.

A summary of each computer program initiated during the report period together with code symbols indicating the extent to which information concerning the program is readily available are given. Programs previously reported are included if changes were made or additional information concerning them was placed in the program library. Abstracts of 704 newsletters and GEORGE bulletins are presented. (For preceding period see ANL-6089.) (W.D.M.)

24457 BLG-49

Brussels. Centre d'Étude de l'Énergie Nucléaire.

TABLES OF RACAH COEFFICIENTS. L. Buyst. Feb. 1960. 5p.

The Racah coefficients w(a,b,c,d,e,f) were tabulated for the following arguments: a, b, and d = 0, $\frac{1}{2}$, 1, ... $\frac{11}{2}$; e and f = 0, 1, ...11; and c = 0, $\frac{1}{2}$, 1, ...$\frac{33}{2}$, with the exception of those already published in USAEC Report ORNL-1679. Information is provided on accuracy, format, and computing time. Tables may be obtained by writing to C.E.N., 31, rue Belliard, Brussels. (W.D.M.)

24458 CF-57-8-92

Oak Ridge National Lab., Tenn.

PROGRAMMERS MANUAL FOR THE ORACLE COMPILER. M. E. LaVerne, R. R. Bate, R. R. Coveyou, J. G. Sullivan, B. J. Osborne, A. C. Downing, J. Harrison, E. C. Long, and A. A. Grau. Aug. 23, 1957. Revised June 15, 1959. 39p. OTS.

Desirable characteristics for the ORACLE compiler are given and limitations, item format, key words, and cross-item references are discussed. Programming and operating procedure are described. (W.D.M.)

24459 LAMS-2435

Los Alamos Scientific Lab., N. Mex.

CROWBAR CODE. D. A. Baker and L. W. Mann. May 1, 1960. 30p. Contract W-7405-eng-36. OTS.

The Crowbar Code is designed for the transient analysis of the linear electrical circuits often used in Project Sherwood experiments to produce strong sustained magnetic fields from charged-capacitor energy sources. The code calculates the natural periods and decay times and the following as functions of time: currents, voltages, instantaneous energy storage, and energy-dissipation rate for each of the circuit elements. The code and input data are loaded into an IBM-704 32K computer from punched cards, and the output results are presented as printed listings and on punched cards for use on a Benson-Lehner plotting machine. (auth)

24460 MND-1721
Martin Co. Nuclear Div., Baltimore.
A PROGRAM FOR THE COMPUTATION OF FISSION PRODUCT ACTIVITY. W. D. Owings. Mar. 2, 1959. 45p.

An IBM 704 program was written and coded by FORTRAN for the computation of fission-product activity after successive periods of reactor operation and shutdown. The code computes decay rates, beta-energy release and gamma-energy release for seven gamma-energy groups by summing the contributions from all the known fission-product radiations in each group. This information may be used directly to determine beta and gamma heating rates and source strengths for attenuation calculations. The source program and sample cases are included. (auth)

24461 OOR-2182:1
Massachusetts Inst. of Tech., Cambridge.
MIFR1: TWO- AND THREE-DIMENSIONAL CRYSTALLOGRAPHIC FOURIER SUMMATION PROGRAM FOR THE IBM 704 COMPUTER (PROGRAM DESCRIPTION AND MANUAL OF OPERATION). William G. Sly and David P. Shoemaker. July 1, 1960. 60p. Contract DA-19-020-ORD-4696.

One of the most important types of crystallographic computations is Fourier Synthesis, which is required for electron-density maps and Patterson diagrams. An efficient and flexible program written for carrying out this kind of calculation on the IBM-704 is described. The program is a revision of WGS. (W.D.M.)

24462 SCTM-259-60(14)
Sandia Corp., Albuquerque, N. Mex.
SOLUTION TO A CLASS OF SINGULAR INTEGRAL EQUATIONS OCCURRING IN MATHEMATICAL PHYSICS (thesis). Fred Alvin Hinchey. Aug. 1960. 76p. OTS.

Submitted to the State Univ. of New Mexico.

A Fourier series solution is developed for a class of singular integral equations that arise in various problems of mathematical physics. This class of integral equations is closely related to certain Wiener-Hopf type equations on the finite range. A brief review of the Wiener-Hopf technique is included as general background. A solution to a similar class of equations on the finite range is given, and the disadvantages of this technique for the solution of a more extended class of equations are pointed out. The first application of this technique that is considered is the problem of the cylindrical antenna. Numerical results are obtained for half and full wavelength center-fed antennas with half length to radius ratios of 60 and 500π. These results are shown to agree with King-Middleton iterative results to within approximately 2%. The second example considered is the problem of the diffusion of neutrons through an infinite plate of finite thickness. No numerical results are obtained for this problem. However, the integral equation is formulated and the solution indicated. (auth)

24463 UCRL-5713(Rev.)
California. Univ., Livermore. Lawrence Radiation Lab.
A TABLE OF SOME SPHERICAL HARMONICS. D. F. Abell. Nov. 1959. 5p. Contract W-7405-eng-48. OTS.

A table of those spherical harmonics useful in the calculation of energy levels of ions in crystalline electric fields was prepared. Various forms of the harmonics are included. (auth)

24464
TRANSISTORIZED APPARATUS FOR ACCUMULATION AND BINARY-DECIMAL CONVERSION. D. Brini, A. Gandolfi, and G. L. Tabellini (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuclear Instr. & Methods 8, 46-54(1960) July. (In English)

An apparatus capable of adding binary numbers and of converting the sum into decimal form is described. The fundamental unit is a decade element having four inputs corresponding to the numbers 1, 2, 4, 8 and an output Z corresponding to the carry. The number which is stored in the decade element can be read directly on an instrument. (auth)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

24465 ANL-6099
Argonne National Lab., Ill.
METALLURGY DIVISION ANNUAL REPORT FOR 1959. 171p. Contract W-31-109-eng-38. OTS.

Engineering Metallurgy. Investigations were made on the following: development programs for Experimental Breeder Reactor No. 2 (EBR-II); fabrication of care and blanket components for Argonne Fast Source Reactor (AFSR); fabrication of spiked fuel rods for Experimental Boiling Water Reactor (EBWR) (Core 1A); fuel for Transient Test Reactor Facility (TREAT); fuel elements for Experimental Breeder Reactor No. 1 (EBR-I) (Mark-IV); canning of plutonium loading for Zero Power Reactor No. 3 (ZPR-III); development of ceramic fuel materials; irradiation evaluations of various experimental fuel and control-rod materials; postirradiation examinations of full-scale reactor fuel elements; development of corrosion-resistant fuel and jacketing materials; nondestructive testing developments; and metallurgical assistance to the Fast Reactor Safety Program. Basic Metallurgy. Investigations were made on the following: preparation of high-purity materials; physical metallurgy of uranium; constitution and properties of uranium and plutonium alloys; alloying properties; x-ray and neutron-diffraction studies; problems in metal physics; corrosion research; irradiation effects; and ceramic-materials research. (W.L.H.)

24466 CF-60-8-82
Oak Ridge National Lab., Tenn.
A METAL TO GRAPHITE JOINT FOR A MOLTEN SALT SYSTEM. J. L. Crowley and W. B. McDonald. Aug. 17, 1960. 15p. OTS.

A two-region graphite-moderated molten-salt thermal breeder reactor with a graphite separator between fuel and blanket fluids will require a graphite-to-metal seal between the core and the blanket regions. One method of sealing is to form a frozen-salt seal separating the fuel and blanket salts. A freeze seal between an Inconel header and a 5-in. dia. graphite (type S-4) crucible is described. Molten salt was circulated past the seal at 1150°F for 24 hr with a differential pressure of 18 psi across the seal. Heat was removed from the seal at a rate of ~4.5 kw by passing water through a coil brazed to the outside metal wall of the seal. No salt leakage was detected past the seal. (auth)

24467 DEG-Report-162

United Kingdom Atomic Energy Authority. Development and Engineering Group, Risley, Lancs, England.

CREEP COLLAPSE OF TUBES UNDER EXTERNAL PRESSURE. J. P. Ellington. Apr. 13, 1960. 19p. BIS.

Using a variational method the behavior is examined of a long tube subjected to external pressure under creep conditions. It is shown that with a nonlinear stress-strain rate relationship collapse with time will always occur. An age-hardening representation of creep is used ($\dot{\epsilon} = mk\,\sigma^n t^{m-1}$), and relatively simple expressions describing the behavior of the tube are obtained for values of the creep index, n = 1, 3, and 5. (auth)

24468 DMIC-Memo-63

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

NOTES ON LARGE-SIZE FURNACES FOR HEAT TREATING METAL ASSEMBLIES. H. J. Hucek, A. R. Elsea, and A. M. Hall. Aug. 25, 1960. 12p. (PB-161213). OTS.

A survey of the availability and location of extra-large-capacity furnaces for heat-treating metal assemblies is presented. (W.L.H.)

24469 DP-298

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.

SUMMARY REPORT ON THORIUM METAL QUALITY FOR PRODUCTION REACTOR USE. Edgar E. Hayes. July 1958. Decl. June 10, 1960. 27p. Contract AT(07-2)-1. OTS.

Background material leading to the development of the metal quality of reactor-grade Th is given. The metal should be sound and of uniform hardness, free of internal cracks and inclusions, and corrosion resistant. It should contain only small amounts of natural U, thorium oxide, and elements that act as reactor poisons. Because of their effect upon metal quality, various methods for the production of Th are discussed. Use of consumable electrode arc melting as the final step has contributed much to the production of Th of excellent quality for reactor use. (auth)

24470 GAT-P-22

Goodyear Atomic Corp., Portsmouth, Ohio.

USE OF MONEL WIRE TUBES IN THE CLEAN-UP REACTOR FILTER. M. L. Geneva, B. W. Penland, and D. B. Jackson. Aug. 18, 1960. 7p. Contract AT(33-2)-1. OTS.

A description and performance of a Monel wire filter for use in the operation of a clean-up reactor in a UF_4-UF_6 conversion facility are presented. (C.J.G.)

24471 HW-64196

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE BLAST CLEANING PROCESS AS AN AID TO VISUAL WELD INSPECTION. G. R. Hanson. Mar. 9, 1960. 12p. Contract AT(45-1)-1350. OTS.

Approximately 5% of the welds on present production fuel elements contain voids just below the surface which are not detectable by visual inspection until they are etched in nitric acid to prepare them for autoclaving. Blast cleaning before weld inspection is a method that readily removes the 0.0003 to 0.0005 in. of surface metal required to reveal these voids and at the same time gives a surface that shows up very small weld voids and removes superficial oxides that now hinder weld inspection. It is recommended that the weld closures of all fuel elements be blast cleaned before weld inspection to aid in detecting weld voids and in removing superficial oxides. Either dry or wet blasting may be used; however, wet blasting requires a washing and drying step that is not necessary in the case of dry-blast cleaning. In addition, dry blasting is faster, and the size of the abrasive is maintained more constant. The cost of incorporating blast cleaning prior to the present visual inspection is estimated at $105,000. (auth)

24472 HW-66408

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NON-METALLIC MATERIALS EVALUATION [FOR] APRIL—JUNE 1960. J. H. Kleinpeter. Aug. 16, 1960. 4p. Contract AT(45-1)-1350. OTS.

Screening tests on ceramics for use as materials of construction for a salt melt cycle revealed Al_2O_3 to be the most promising. (For preceding period see HW-65497.) (C.J.G.)

24473 IDO-16574

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PROGRESS REPORT ON FUEL ELEMENT DEVELOPMENT AND ASSOCIATED PROJECTS. W. C. Francis—S. E. Craig, ed. Aug. 16, 1960. 151p. Contract AT(10-1)-205. OTS.

The fuel development program at the Materials Testing Reactor (MTR) has sought to develop improved, economical, long-life fuel assemblies through a comprehensive study of various fuel compositions, enrichments, claddings, burnable poisons, fuel and poison distributions, and fuel-element geometry optimization. The core materials, including uranium—aluminum alloys, uranium oxide—aluminum cermets, thorium, thorium oxide, boron, gadolinium, dysprosium, and iridium, are tested in pilot-plant scale by irradiating them as sandwich type sample fuel plates. In the procurement of these sample plates, fabrication techniques were developed and evaluated for incorporation of all the fuels and poisons (except Ir_2O_3) into cores of aluminum or aluminum alloys. Methods were developed to minimize "dog-boning" and to produce graded fuels. Some of the sample plate compositions have been irradiated to high burn-up, i.e., over 50% of the U^{235} content, and have operated successfully in the MTR for seven or more cycles. The irradiated uranium—aluminum alloy and uranium oxide—aluminum cermet fuel plates have shown excellent dimensional stability and good corrosion resistance to long-term irradiation. However, some of the thorium oxide fuel plates failed during one cycle of irradiation because of blistering, rupturing, or forming of pinholes in the cladding. The isostatic bonding procedure used to bond aluminum plates to the ThO_2 cores is apparently not adequate for reactor use. The sample fuel plate work has demonstrated the suitability of high wt.% uranium oxide—aluminum fuels for testing reactors, indicated the potential of systematically varying the fuel loading within a single plate, and experimentally verified the applicability of burnable poisons for reducing reactivity changes resulting from fuel burn-up. The Reactivity Measurement Facility has proved to be an excellent nondestructive analytical tool for determination of fuel and poison burn-up. This program has stimulated several new developments and revealed many interesting facts in the fabrication and testing of reactor fuel materials. For example: (1) ultrasonic inspection has proved to be an excellent nondestructive method for determination of small voids in the core and unbonded cladding not otherwise detected by radiographing, (2) the ultrasonic inspection of irradiated fuel plates in the MTR canal is feasible, and (3) analytical procedures were developed for the determination of the small quantities of gadolinium added to the cores. The prototype studies consisted of theoretical and experimental evaluations of the hydraulic and heat-transfer characteristics, the structural properties, the economics and the reactor operating characteristics of various full-sized fuel assemblies and shim rods. The results of the sample fuel plate studies were incorporated in these prototypes to obtain optimum practical designs for testing reactors. The fuel element geometries investigated include plates, tube bundles, hexagonal honeycomb, and concentric cylinders. A MTR shim rod with renewable fuel and poison sections was designed, tested hydraulically, and is now considered ready for final in-pile testing. This rod outlasts the existing shim rods, is cheaper, and allows more operational flexibility. A theoretical analysis, hydraulic tests, and a mechanical evaluation have shown that an improvement can be made in plate type fuel elements by using an increased number of thinner high-strength fuel plates in the fuel element. An in-pile prototype test of such an element is now planned. An analysis of roughened surfaces indicates that economy or increases in reactor power may be gained through the use of roughened heat-transfer surfaces in nonboiling water-cooled reactors. Preliminary hydraulic tests were performed and indicate that practical roughened surfaces may be formed. Out-of-pile heat-transfer tests are now planned. The theoretical analysis of geometries indicates that tube bundles, honeycomb, and concentric cylinder designs come close to eliminating wasted space and hot spots in a reactor element. Out-of-pile tests of a tube bundle element have shown that fabrication techniques of this type element must be improved. No reasonable fabrication techniques for a honeycomb element have yet been demonstrated. A fuel element composed of concentric square cylinders having rounded corners was designed and fabrication of a dummy prototype is in progress. The current fuel development program seeks to extend the materials and prototype studies. Combinations of fuels and poisons in nonuniform distributions and the high-temperature applications of aluminum fuels are being evaluated. (auth)

24474 MET-53
Atomic Energy of Canada Ltd., Chalk River, Ont.
REACTOR GRADE ZIRCALOY-4 INGOT. Issue No. 2. E. C. W. Perryman. July 15, 1960. 6p.

A specification is given for the preparation of Zircaloy-4 ingot for reactor use. (W.L.H.)

24475 MET-54
Atomic Energy of Canada Ltd., [Chalk River, Ont.].
ZIRCALOY-2 WIRE MATERIAL. Issue No. 2. E. C. W. Perryman. July 15, 1960. 8p.

Specifications are given for Zircaloy-2 wire material for reactor use. (W.L.H.)

24476 MET-55
Atomic Energy of Canada Ltd., Chalk River, Ont.
ZIRCALOY-4 WIRE MATERIAL. E. C. W. Perryman. July 15, 1960. 8p.

A specification is given for the production of Zircaloy-4 wire material for reactor use where integrity and satisfactory corrosion resistance at elevated temperatures are required. (W.L.H.)

24477 MET-56
Atomic Energy of Canada Ltd., Chalk River, Ont.
ZIRCALOY-2 TUBING FOR FUEL SHEATHING. E. C. W. Perryman. July 15, 1960. 10p.

A specification is given for the production of Zircaloy-2 tubing, both seamless and welded, for reactor fuel rod sheathing. (W.L.H.)

24478 MET-57
Atomic Energy of Canada Ltd., Chalk River, Ont.
ZIRCALOY-4 TUBING FOR FUEL SHEATHING. Issue No. 2. E. C. W. Perryman. July 15, 1960. 10p.

A specification is given for Zircaloy-4 tubing, both seamless and welded, for reactor fuel rod sheathing. (W.L.H.)

24479 MET-58
Atomic Energy of Canada Ltd., Chalk River, Ont.
ZIRCALOY-2 SHEET AND STRIP MATERIAL. E. C. W. Perryman. July 15, 1960. 9p.

Specifications are given for Zircaloy-2 sheet and strip material for reactor use where high integrity and satisfactory corrosion resistance at elevated temperatures are required. (W.L.H.)

24480 MET-59
Atomic Energy of Canada Ltd., Chalk River, Ont.
ZIRCALOY-4 SHEET AND STRIP MATERIAL. Issue No. 2. E. C. W. Perryman. July 15, 1960. 9p.

Specifications are given for Zircaloy-4 sheet and strip material for reactor use where high integrity and satisfactory corrosion resistance at elevated temperatures are required. (W.L.H.)

24481 NMI-2087
Nuclear Metals, Inc., Concord, Mass.
FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Progress Report for July 1960. Aug. 31, 1960. 21p. Contract AT(30-1)-1565. OTS.

The adaptation of the honeycomb and dimpled-sheet techniques to the production of clad fuel elements is reported. Heat-treatment studies on alloys of Be with Fe, Cr, Pd, and Nb were initiated. Thermal analysis work was started on the Be—Co and Be—Mn alloy systems, and additional work was done on the Be—La system. Water quenching of pure Be and a Be—8 at. % Ni alloy from the liquid phase was tried, but no beta retention was observed. A program to study the mechanical properties of beta-phase Be—Ni alloys has begun. A number of fabrication techniques are being investigated for the fabrication of ThO_2-UO_2 fuel elements. An investigation into the mechanism of the corrosion of Zr alloys in high-temperature steam with emphasis on the role of intermetallic precipitates in the mechanism is reported. (W.L.H.)

24482 NMI-4377(Suppl.)
Nuclear Metals, Inc., Concord, Mass.
SPHEROIDIZATION HEAT TREATMENT AND RE-EVALUATION OF ZIRCALOY-CLAD U-2 w/o Zr ALLOY TUBE NO. 28, EXTRUSION NO. 18388. D. F. Kaufman, R. G. Jenkins, and W. B. Tuffin. July 29, 1960. 38p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. OTS.

The supplementary heat-treatment and re-evaluation of the Zircaloy-clad U-2 wt.% Zr alloy tube No. 28 are described. The previous processing of this tube included both a diffusion anneal and an autoclave acceptance test. As a part of a program for preparing irradiation specimen fuel tubes having cores with radically different metallurgical structures, tube 28 was heat-treated again, reprocessed through another corrosion test, and shipped. (See also NMI-4377.) (W.L.H.)

24483 NP-9014
Battelle Memorial Inst., Columbus, Ohio.
DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS. M. J. Wahll, comp. June 1960. 142p.

Abstracts are presented on properties, applications, and fabrication of Ti, Be, Mo, Nb, Ta, Cr, W, steels, stainless steels, Ni alloys, Co alloys, and high-strength alloys. Abstracts are included on coatings, fabrications, and applications of nonmetallic refractories. (C.J.G.)

24484 NP-9029
General Electric Co. Flight Propulsion Lab., Dept., Cincinnati.
THE EFFECT OF ARC PLASMA DEPOSITION ON THE STABILITY OF NON-METALLIC MATERIALS. Bi-Monthly Report No. 1 Covering period March—April 1960. B. E. Kramer and M. A. Levinstein. June 3, 1960. 14p. Contract NOas 60-6076-c. (DM-60-125).

A literature survey was conducted to compile the available data on the materials selected for investigation. Most of the materials were procured except for HfB_2 and TaN. Cost of some of the materials is very high, exceeding $100 per lb. Many of the materials are available only as very fine powders; this has necessitated a search for an effective powder-feeding mechanism. A new hopper design was evaluated which gives controllable feeding rates for powders of 10-μ size. All the spraying will be done in a controlled-environment tank. This is of particular importance with the carbides, nitrides, and borides, which are subject to decomposition when sprayed in air. (auth)

24485 NP-9061
Central Inst. for Industrial Research, Blindern, Norway.
HIGH TEMPERATURE OXIDATION OF NIOBIUM. Technical (Scientific) Note No. 2 for April 1, 1959 to March 31, 1960. Per Kofstad, Hallstein Kjøllesdal, Joar Markali, and Nico Norman. Apr. 1960. 64p. Contract AF61(052)-90. (SI-Publ.-282).

The oxidation behavior of Nb was studied at 500 to 1200°C and at O pressures of 760, 100, 10, 1, and 0.1 mm of Hg. Kinetic studies of the oxidation and structural investigations of the oxidized specimens were performed by means of x-ray diffraction, electron diffraction, electron microscopy, and metallographic techniques. Reversals in the temperature coefficient of the oxidation were found in two temperature regions (at about 600 and 800°C) depending upon the O pressure. The complex oxidation behavior is suggested to be due to formation of different Nb_2O_5 modifications in different temperature regions, and to the ability of the oxide to deform plastically and form protecting scales with decreasing O pressure. In addition to oxide scale formation, O is dissolved in the metal during the oxidation. Growth of oxide whiskers consisting of single crystals of $\alpha-Nb_2O_5$ was found to take place on the oxide surface at temperatures above approximately 800°C. (auth)

24486 NP-9106
Battelle Memorial Inst., Columbus, Ohio.
DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS. M. J. Wahll, comp. July 1960. 187p.

A current listing of selected documents and journal articles is presented on light metals (Ti, Be, and B), refractory metals (Mo, Nb, Ta, Cr, and W), the platinum group, steels, and high-strength alloys. Also included are listings of reports of special metal applications, coatings, fabrications, nonmetallic refractories, properties, and thermal protection. (W.L.H.)

24487 NP-9112
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE CONSTITUTION AND FABRICATION OF URANIUM—MOLYBDENUM—PLUTONIUM FUELS. P. G. Mardon, J. P. Evans, D. J. Hodkin, J. M. North, and J. H. Pearce. [1959]. 47p.

Presented at the International Conference on the Metallurgy of Plutonium, Grenoble, France, April 19-22, 1960.

Some features of the constitution of U-rich U—Mo—Pu alloys with particular reference to the extent of the γ-U field are described. Solidus and liquidus contours were determined by differential thermal analysis and metallography; the former technique was also used on alloys with low Mo contents for the construction of isopleths to illustrate the complex reactions present in this part of the system. A proposed scheme of reactions for U-rich alloys is given. Experience on resistance melting of the alloys under vacuum and their segregation behavior is described. Considerable variations which were observed in the rolling behavior of the alloys are also described. (auth)

24488 ORNL-2080(Del.)
Oak Ridge National Lab., Tenn.
METALLURGY DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING APRIL 10, 1956. Nov. 2, 1956. Decl. with deletions Nov. 13, 1959. 209p. Contract W-7405-eng-26. OTS.

Tests of materials for use in liquid-metal and fused-salt systems were continued. Corrosion tests, penetrability tests, thermal tests, and solubility tests were conducted on structural alloys, brazing alloys, special alloys, cermets, carbides, nitrides, and rare-earth oxides. Progress in loop design and testing is reported. Hastelloy W creep and stress testing and general welding and brazing tests and investigations are reported. Development work is reported in nickel-molybdenum base alloys and iron-zirconium alloys and the fabrication of control rods. Research in the physical chemistry of corrosion, fundamental and applied metallurgy, and ceramics is reported. Development of alloys, fuel assemblies and fuel alloys, and brazing and welding techniques for the Homogeneous Reactor Project (HRP) and the Army Package Power Reactor (APPR) and testing of these materials in the Materials Testing Reactor (MTR) are described. (W.L.H.)

24489 ORNL-2685
Oak Ridge National Lab., Tenn.
[PAPERS PRESENTED AT] ANP MATERIALS MEETING NOVEMBER 16-18, 1954, [WRIGHT AIR DEVELOPMENT CENTER, DAYTON, OHIO]. Mar. 26, 1959. Decl. May 9, 1960. 168p. Contract W-7405-eng-26. OTS.

Screening tests were conducted on materials for pump bearings, valves, and seals for fluorides and sodium. The specimens were loaded into Inconel containers along with a sodium or fluoride bath. Ceramics and cermets were dynamically tested in fluorides and sodium. Stress-rupture data are presented for Inconel in fused fluoride salts. Joining methods and procedures are reported for the fabrication of compact and relatively complex radiators and heat exchangers for circulating fuel reactors. Typical radiator designs are shown. The fabrication of control rods and reactor shielding is described. The corrosion of stainless steel and Inconel by Li, Na, and Rb is reported. The compatibility of Be, Na, and Inconel is discussed. Requirements of container materials for circulating-fuel reactors are presented. It is shown that Inconel is a successful container material for reactors of this type. The corrosion of various metals by molten fluorides is discussed. A study was made of the mass transfer and corrosion characteristics of a number of metals and alloys in liquid lead. (W.L.H.)

24490 ORO-309
National Carbon Co. Research Labs., Cleveland and National Carbon Co. Product and Process Development Lab., Fostoria, Ohio.
GRAPHITE-MATRIX NUCLEAR FUEL ELEMENTS. Interim Status Report [for] November 1, 1959 through June 30, 1960, Phase II. July 15, 1960. 57p. Contract AT(40-1)-2560. OTS.

Experiments were made with various blending procedures to promote maximum uniformity of dispersion of fuel spheroids in the graphite matrix. A liquid-solids twin-shell blender has produced best results to date. Migration of the fuel material within and from the graphite matrix during high-temperature processing can be controlled to a safe and economical level. Studies are underway, but are as yet incomplete, to determine the time-temperature relationship of the conversion of uranium oxides to uranium carbides. A study has begun to determine practical methods of reusing fueled scrap in fuel-element manufacture. The amount of low-viscosity liquid picked up under pressure by a coated fuel element appears to be a reliable, economical measure of coating integrity. Preirradiation data and such postirradiation data as are presently available are reported for the ORNL-MTR-48-1 capsule-irradiation test conducted in the HB-3 beam hole of the Materials Testing Reactor. Conditions of this test were such that the exposure to fission fragments was equivalent to realistic fuel-element lifetimes in operating reactors. Description of the ORNL-MTR-48-2 capsule-irradiation test, scheduled to begin the last of June, is presented. This will be a sweep capsule test to determine fission-product retention or release. (auth)

24491 USBM-U-745
Bureau of Mines. Albany Metallurgy Research Center, Ore.
QUARTERLY METALLURGICAL PROGRESS REPORT NO. 7 FOR THE PERIOD OF APRIL 1, 1960 TO JUNE 30, 1960. 50p. Contract AT(11-1)-599. OTS.

Investigations were made to improve existing methods and to develop new methods for preparing high-purity yttrium metal. It was established that high-purity yttrium chloride can be prepared by a wet process which involves the careful dehydration of the hydrated chloride in the presence of ammonium chloride at conversion efficiencies of 96 to 99%. Yttrium metal with a purity greater than 99.9% was prepared by both sodium and lithium reduction of yttrium chloride. Room-temperature fabrication tests demonstrated that high-purity yttrium metal can be hammer or press-forged, cold-rolled, extruded, and deep-drawn. High-purity thorium metal was prepared by the reduction of thorium tetrachloride with "reactor grade" sodium. Thorium metal sponge was vacuum-arc melted and fabricated into rod, bar, and sheet. Two methods involving the separation of zirconium from hafnium were studied in attempts to develop an economical process for the preparation of an enriched hafnium concentrate from zircon ore. The hafnium–tantalum phase diagram was established as a eutectoid type; but whether it is the conventional eutectic–eutectoid type or a type with complete high-temperature solubility was not established. Investigation of rare-earth alloys established the zirconium–gadolinium phase diagram as a simple eutectic with a peritectoid reaction at 890°C and about 5% gadolinium. The diagram for stainless steel (type 304)–gadolinium was partially established, and the stainless steel (type 304)–samarium alloy system was briefly examined. A phase diagram for the binary system (titanium–gadolinium) was completed. Evaluation of air-cooled copper crucibles to be used for arc melting zirconium has indicated the need for increased heat transfer from the crucible to the coolant. The techniques for producing expendable graphitic molds for casting zirconium and hafnium are reported. (For preceding period see USBM-U-699.) (W.L.H.)

24492 USNRDL-TR-148
Naval Radiological Defense Lab., San Francisco.
PROTECTIVE COATINGS FOR CONCRETE. R. H. Heiskell and R. J. Crew. May 16, 1957. 31p.

Sample cubes of mortar and concrete were coated with experimental formulations and various commercially available protective coatings and sealers. These were tested for water absorption by immersion for 24 hr. Only 2 experimental formulations and 14 commercial coatings of the 66 tested reduced the water absorption by 90%. Preliminary decontamination tests, in which La^{140} and Np^{239} were used as contaminants, indicated that coatings which showed the highest resistance to water absorption were, in general, the easiest to decontaminate. (auth)

24493 WADC-TR-58-12(Pt.III)
Illinois. Univ., Urbana.
HIGH-TEMPERATURE ELECTRICAL INSULATING INORGANIC COATINGS ON WIRE. [Period covered]: February 1959 to February 1960. David L. Wilcox, Clifton G. Bergeron, Paul F. Schwarzlose, and Arthur L. Friedberg. May 1960. 75p. Project 7371. Contract AF33(616)-3943, Supplemental Agreement No. 3(59-827). OTS.

Flexibility studies indicated that the ratio of coating thickness to wire diameter and the cooling cycle were important factors affecting flexibility of the coating. Annealing of coated wire followed by an oil quench increased the flexibility of the coating. Coatings on Inconel clad Cu wire exhibited less flexibility than coatings on plain Cu wire. Insulating coating studies on clad Cu wires indicated that: (1) with Inconel- or silver-clad wires, good adherence was obtained with composition 58 containing 4% NiO and 10% FeO (for Inconel-clad wires) and 10% MoO_3 (for Ag-clad wires); and (2) with stainless steel-clad wire, fair adherence was obtained with composition 58 containing 10% CuO. The optimum firing procedure for two coats of 58c on Cu wire was determined. Additions of vitreous silica and BN to the mill formula of coatings 58 and 58c were found to enhance the electrical properties of the resulting coating. The dissipation factor and room temperature dielectric constant of vitreous coatings on Cu wire appeared to be insensitive to the five cracks present in the flexed coating. (For preceding period see WADC-TR-58-Pt.II) (C.J.G.)

24494 WADC-TR-59-316(Pt.II)
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
MECHANISM OF WEAR OF NONMETALLIC MATERIALS. Period covered: June 1958 to May 1959. C. H. Riesz. Feb. 1960. 25p. Project No. 7022. Contract AF33(616)-5962.

A fundamental study was made of the wear mechanism of nonmetallic materials at high temperatures. Single-crystal sapphire was examined in a friction apparatus made for studies up to 2200°C. A sapphire ball loaded at 22, 50, and 127 g was passed over a sapphire plate at .0053 cm/sec at 29 to 921°C. Both slider and plate were oriented so that the C_0-axis was normal to the direction of traverse. With cleaned, as-received materials, coefficient-of-friction values were scattered. Prior heat treatment at 900 to 925°C reduced scatter and gave peak values of 0.25 to 0.30 near 600°C. The results suggest that the surfaces of the sapphire were imperfect. Observations by other investigators on variation of modulus of rupture appear to have a common basis. Wear areas on ball and plate were 6μ wide; subsurface changes extended to 30μ. Electron microscopy inspection suggests that high surface temperatures occurred coincidently with the friction process, but direct evidence of an adhesion mechanism is inconclusive. (auth)

24495 WCAP-1630
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

THERMOELECTRIC NUCLEAR FUEL ELEMENT MONTHLY PROGRESS REPORT NO. 26 COVERING THE PERIOD AUGUST 1960. G. R. Kilp, W. P. Blankenship, R. C. Goodspeed, R. A. Markley, and P. V. Mitchell. Sept. 10, 1960. 14p. Contract AT(30-3)-500. OTS.

Five bomb-melting experiments were performed on the uranium thermoelectric compounds. Two bombs served adequately, but three developed leaks at the spun end caps. Pressed caps are being developed. Thermoelectric property measurement of uranium compounds is reported. Fabrication-process variables were evaluated for lead telluride. A hot-swaged couple exceeded 1000 hours on life test. In other work, fabrication problems attendant upon swaging thermoelectric elements are being investigated. Axial movement and shorting of heaters, asymmetry and shorting of thermoelectric material, and insulation breakdowns are being eliminated. At the same time closer tolerances are being achieved and complex features such as nonuniform loading of thermoelectric materials are being introduced. (J.R.D.)

24496 JPRS-5081
PRODUCTION AND PHYSICAL METALLURGY OF PURE METALS. PART V. A. I. Evstyukhin (Yevstyukhin), G. A. Leont'ev (Leont'yev), V. V. Nikishanov, N. V. Borkov, V. S. Emel'yanov (Yemel'yanov), and Yu. G. Godin. Translated from Met. i Metalloved. Chistykh Metallov, No. 1, 106-43 (1959). 46p. OTS.

A compilation of papers is presented in which information is given on arc melting of refractory metals and alloys under laboratory conditions, construction and operational experience with graphite heating element furnaces for vacuum melting, and mechanical properties of binary and ternary alloys of zirconium with tantalum and niobium at various temperatures. Separate abstracts were prepared for each of the three included papers. (J.R.D.)

24497 JPRS-5081(p.19-25)
CONSTRUCTION OF AND OPERATIONAL EXPERIENCE WITH THE HIGH TEMPERATURE MIFI-9-2 FURNACE WITH A GRAPHITE HEATING ELEMENT FOR VACUUM MELTING AND CASTING OF PURE METALS AND ALLOYS. A. I. Evstyukhin (Yevstyukhin), G. A. Leont'ev (Leont'yev), and N. V. Borkov. Translated from Met. i Metalloved. Chistykh Metallov, No. 1, 122-7(1959).

The design, construction, and operational experience with a high-temperature vacuum furnace for melting pure metals and preparation of melts weighing 50 to 1000 g are described. Melting in graphite or coated crucibles can be carried out. The molten metal can be cooled in the furnace or poured into a mold situated below. (J.R.D.)

24498 JPRS-5195
PRODUCTION AND PHYSICAL METALLURGY OF PURE METALS. PART VIII. E. (Ye.) V. Borisov, P. L. Gruzin, L. V. Pavlinov, G. B. Fedorov, Yu. F. Bychkov, A. N. Rozanov, A. F. Klimov, and D. M. Skorov. Translated from Met. i Metalloved. Chistykh Metallov No. 1, 213-43 (1959). 43p. OTS.

A compilation of papers is presented in which information is given on molybdenum self-diffusion, diffusion of tungsten in molybdenum, diffusion in high-temperature cobalt-base alloys, physical property changes during decomposition of the β phase in zirconium–niobium alloys, and effects of alloying on Young's modulus for zirconium. Separate abstracts were prepared for each of the four included papers. (J.R.D.)

24499 JPRS-5195(p.1-8)
SELF-DIFFUSION OF MOLYBDENUM AND DIFFUSION OF TUNGSTEN IN MOLYBDENUM. E. (Ye.) V. Borisov, P. L. Gruzin, L. V. Pavlinov, and G. B. Fedorov. Translated from Mėt. i Metalloved. Chistykh Metallov No. 1, 213-18 (1959).

An investigation of molybdenum self-diffusion and the diffusion of tungsten in molybdenum at 1800 to 2175°C is described. Mo^{99} and W^{185} were used as tracers in the tests. Data on the self-diffusion coefficient for molybdenum, and on the diffusion coefficient for tungsten in molybdenum in relation to the test temperatures, are included. (J.R.D.)

24500 JPRS-5195(p.9-17)
DIFFUSION IN HIGH-TEMPERATURE ALLOYS ON A COBALT BASE. P. L. Gruzin and G. B. Fedorov. Translated from Met. i Metalloved. Chistykh Metallov No. 1, 219-23 (1959).

Research is described on diffusion of elements in cobalt-base alloys, and in the chromium and tungsten strengthening phases. It was concluded that in the area of working temperatures (850 to 1250°C), the threshold level of diffusion mobilities for cobalt-base alloys is characterized by diffusion coefficients on the order of 10^{-12} to 10^{-13} cm^2/sec. (J.R.D.)

24501
APPLICATION OF RADIOELEMENTS TO THE STUDY OF THE PURIFICATION OF ALUMINUM. Ph. Albert, J. Gaittet, and G. Chaudron. Compt. rend. congr. intern. chim. ind., 31^{e}, Liège, Belg., 1958 1, 809-12. (In French)

Very high purity aluminum was obtained which has interesting properties. A purity of 99.999 was obtained by zone melting that can achieve a concentration below 5 ppm. To check the purity a method of analysis by radioelements was used. (T.R.H.)

24502
LOCALIZATION OF RADIO-ACTIVE IMPLANTS WITH IMAGE INTENSIFICATION AND TELEVISION. J. J. Stevenson (Royal Marsden Hospital, London). Proc. Roy. Soc. Med. 53, 644-5(1960) Aug.

A biplane fluoroscope fitted with an industrial television chain was developed for use in the localization of radioactive material during implantation of the pituitary gland of patients. An image intensifier was used which employs an electron optical tube consisting essentially of two fluorescent screens with a high potential difference between them. When x rays strike the front screen, they fluoresce in the normal manner. Electrons are emitted from the posterior surface in direct proportion to the amount of fluorescence immediately in front. The negatively charged particles are accelerated across to the anode end of the tube and are focused on the smaller screen at the rear. Owing to the difference in the areas of the two screens and the impact with which the electrons strike the smaller, its brightness is several hundred times greater than that of the other. With the aid of a simple optical attachment, it is possible for the observer to use smaller amounts of x rays and at the same time see the image in greater detail. The clinical examination can be carried out in a fully-lighted room. An industrial television chain was adapted for use in conjunction with the image intensifier for the benefit of the operating-room audience. (C.H.)

24503
NUCLEONICS IN ANALYSIS. W. Wayne Meinke (Univ. of Michigan, Ann Arbor). p.3-10 of "Symposium on Radioisotopes in Metals Analysis and Testing."

An attempt was made to put nuclear methods in perspective and to give a hint of the wide possibilities for these methods. Nuclear applications in most fields are analytical in nature. By the utilization of the nuclear properties of radioisotopes, it is possible to trace or detect components of systems that otherwise could not be observed. The different applications can be divided into two major categories. The first category includes applications that use radioisotopes as sources and the second includes applications that use them as tracers. (B.O.G.)

24504
NUCLEAR REACTOR FUEL PREPARATION. (to U. S. Atomic Energy Commission). British Patent 844,833. Aug. 17, 1960.

Stable slurries of UO_2 in bismuth can be prepared for use as reactor fuel by heating and agitating in a sealed steel capsule a mixture of bismuth oxide, bismuth, and uranium in such proportions that the amount of bismuth oxide is somewhat less than that required theoretically to oxidize uranium to UO_2, the atomic O/U ratio being preferably about 1.67. The reason for such a low proportion of bismuth oxide is that some O_2 is already available in the capsule, some of the uranium is rendered unavailable by reaction with the capsule wall, and UO_2^+ is not readily dispersible in bismuth. Several heating schedules are given for making stable slurries, and an experiment was performed which yielded a uniform slurry containing UO_2 and was free from slag. It was found that an atomic O/U ratio of 1.67 gave no separation of free oxide, whereas a ratio of 1.95 gave slurries with unwetted and segregated oxide. (D.L.C.)

24505
PRODUCTION OF METALS. Leslie Jack Derham (to United Kingdom Atomic Energy Authority). British Patent 846,490. Aug. 31, 1960.

A method is presented for producing metallic titanium, zirconium, uranium, and thorium by reduction of their halides with magnesium. The method consists of mixing the dried and crushed metal halide with finely divided magnesium raspings in stoichiometric proportions, compacting the mixture into 1 by 1-in. briquettes, charging the briquettes into a molten alkali fluoride or chloride medium in a reaction vessel, heating to initiate reduction, cooling until the metal solidifies, and scooping the metal out of the molten salt. When the metal is cold, it is washed with H_2O or heated in high vacuum to free it from $MgCl_2$ and melt components. This method can be used for reducing the lower chlorides of titanium ($TiCl_3$ and $TiCl_2$), zirconium, UF_4, and $ThCl_4$. It can also be used to separate zirconium from hafnium in $ZrCl_4$ containing some $HfCl_4$ by using a limited quantity of magnesium. (D.L.C.)

Corrosion

24506 CEA-1314
Tréfileries et Laminoirs du Havre. Centre de Recherches, Antony, France.
TENUE A LA CORROSION PAR L'EAU A HAUTE TEMPÉRATURE DE L'ALLIAGE Al—Fe—Ni APRÈS DES CHAUFFAGES DE LONGUE DURÉE. INFLUENCE DES ADDITIONS Ti ET Zr. (Resistance to Corrosion by Water at High Temperatures of Al—Fe—Ni Alloy after Prolonged Heat Treatment. Influence of Ti and Zr Additions).
P. Lelong, J. Moisan, and J. Herenguel. Sept. 10, 1959. 30p. Contract No. 2852.

For presentation at the Conference on Corrosion in Nuclear Reactors, Brussels, October 14, 15, and 16, 1959.

The influence of Ti and Zr additions on the heterogeneity texture of Al—Fe—Ni alloys and the resultant effect on their corrosion resistance is briefly described. The results are given of corrosion tests on these alloys after prolonged heat treatment. Without additions, the eutectic structure of the basis alloy is subject to a coalescence, which results in a deterioration of corrosion resistance. This effect applies equally to the as-cast and to the wrought conditions. The addition of Ti or Zr retards this deterioration very considerably, both for the as-cast and wrought alloys. (auth)

24507 LMSD-288140(Vol. II)(Paper 10)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
STUDY OF HALIDE-CONTAINING OXIDE FILMS ON COLUMBIUM. F. J. Clauss and S. Drake. Paper 10 of GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME II. 13p.

An experimental survey was made of the feasibility of retarding oxidation at elevated temperatures by pretreatment to form oxide films containing halide ions. Best results were obtained with films formed by reaction at about 900°F in mixtures of oxygen and a halide-containing gas (e.g., hydrogen chloride) at reduced pressures. Films formed in this manner were significantly more resistant to oxidation during subsequent heating in air at temperatures to about 900°F than the oxide films formed during normal oxidation in air. Films were produced that were stable during heating in air to about 900°F with no flaking or spalling during subsequent cooling to room temperature. (auth)

24508 NAA-SR-5282
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
CARBURIZATION OF AUSTENITIC STAINLESS STEEL IN LIQUID SODIUM. W. J. Anderson and G. V. Sneesby. Sept. 1, 1960. 32p. Contract AT-11-1-GEN-8. OTS.

Results are presented of experimental research concerned with carbon transfer in liquid sodium—304 stainless steel systems. The general nature of the reactions is discussed, and experimental techniques are described. The reaction rates in the liquid sodium system were found to be rapid, and carburization rates for the steel were governed by diffusion rates. The carbon content of 304 stainless steel in equilibrium with carbon-saturated sodium varies from 2.68% at 1000°F to 4.35% at 1600°F. Sodium containing 15 to 18 ppm carbon is in virtual equilibrium with uncarburized 304 stainless steel at 1200°F, when the oxygen concentration in the sodium is less than 40 ppm. Diffusion coefficients for carbon in 304 stainless steel are presented in the temperature range of 1000°F to 1600°F. A method of using micro-hardness data from carburized stainless steel specimens for indirectly determining the carbon content of sodium is described. (auth)

24509 NMI-1220
Nuclear Metals, Inc., Concord, Mass.
PROCEEDINGS OF THE NINTH ANNUAL AEC CORROSION SYMPOSIUM, MAY 10-12, 1960. J. Paul Pemsler. July 18, 1960. 55p. OTS.

Abstracts are presented for the unclassified papers given at the symposium. The classified papers are listed by title only. The papers covered the following subjects: zirconium; hafnium, niobium, and aluminum; new concepts in corrosion research; fundamental studies; liquid metals; gas-cooled reactors; and in-pile corrosion, contamination and decontamination. (W.L.H.)

24510 ORNL-2391
Oak Ridge National Lab., Tenn.
CORROSION RESISTANCE OF VARIOUS CERAMICS AND CERMETS TO LIQUID METALS. W. H. Cook. June 15, 1960. 27p. Contract W-7405-eng-26. OTS

The procedures used for the corrosion screening testing of ceramics and cermets in liquid Li, Na, and Pb are discussed briefly. The results of such tests on various ceramics and cermets exposed for 100 hr to the liquid metals at 1500°F are given. These include various borides, carbides, nitrides, oxides, and silicides for the ceramics. The major part of the cermet screening corrosion tests reported are on tungsten carbide- and titanium carbide-base cermets. Some present and future uses for corrosion resistant ceramics and cermets are outlined. (auth)

24511 AEC-tr-4214

THE EFFECT OF THERMAL TREATMENT OF 1Kh18N9T STAINLESS STEEL WITH DIFFERENT CARBON–TITANIUM RATIOS ON ITS RESISTANCE TO INTERCRYSTALLITE CORROSION. E. I. Astrov and V. N. Biryukova. Translated from Vestnik Mashinostroeniya 33, No. 9, 61-5 (1953). 8p. JCL or LC.

Results are given of tests carried out with the aim of establishing the effect of the conditions of thermal treatment of stainless steel containing C and Ti in various ratios on intercrystallite corrosion. The problems investigated were the effect of the hardening temperature, the residence time and the rate of cooling on the grain size, and the extent of intercrystallite corrosion of steel; the effect of hardening and annealing on the amount and the distribution character of carbides in the steel; and the effect of the conditions of thermal treatment on the hardness and mechanical properties of steel. (W.L.H.)

24512

THE KINETICS OF WUSTITE SCALE FORMATION ON IRON. W. W. Smeltzer (Carnegie Inst. of Tech., Pittsburgh). Acta Met. 8, 377-83(1960) June.

The kinetics of scale formation on iron in carbon dioxide atmospheres were determined at 600 to 1100°C by a thermogravimetric technique. The scale constituents were identified by means of x-ray and microscopic examinations. The oxidation rates obeyed linear and parabolic time laws for short and long exposures, respectively. Linear scaling was determined by the rate of incorporation of chemisorbed oxygen into the wustite lattice at temperatures lower than 910°C and by dissociation of carbon dioxide and incorporation of oxygen into wustite at higher temperatures. The theoretical temperature coefficient of the parabolic rational-rate constant for wustite formation was evaluated over the temperature range of its stability. Results from the literature on parabolic oxidation of iron in oxygen were in good agreement with the theoretical evaluation, whereas the results obtained for oxidation in carbon dioxide were of smaller magnitude above the Curie temperature of iron. This behavior was explained by the consideration that the chemical activity of oxygen in wustite at the oxide-gas interface was insufficient for equilibration of wustite with magnetite. (auth)

24513

STUDY OF CORROSION AND ELECTROCHEMICAL BEHAVIOUR OF STAINLESS STEELS IN THE COURSE OF CATHODIC POLARIZATION IN NITRIC ACID SOLUTIONS. 2. CATHODIC PROCESSES DEVELOPING ON THE SURFACES OF STAINLESS STEELS IN NITRIC ACID SOLUTIONS. E. N. Mirolyubov, M. M. Kurtepov, and N. D. Tomashev (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 7, 1178-84(1960) July. (In Russian)

A cathodic process, autocatalyzed by nitric acid, was observed when stainless steel was placed in nitric acid solutions. In a totally dissociated solution, nitric acid forms during nitrate and hydrogen ion interactions with corrosion products (Fe^{2+} and Cr^{2+}). A cathodic hydrogen separation process in active steels was noticed in the region of strong negative potentials. (R.V.J.)

24514

STUDY OF CORROSION AND ELECTROCHEMICAL BEHAVIOUR OF STAINLESS STEELS IN THE COURSE OF CATHODIC POLARIZATION IN NITRIC ACID SOLUTIONS. 3. EFFECT OF STEELS COMPOSITION. E. N. Mirolyubov, M. M. Kurtepov, and N. D. Tomashev (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 7, 1185-90(1960) July. (In Russian)

The influence of nickel and chromium content on stainless steel corrosion by nitric acid is analyzed. A decreasing iron–chromium diffusion rate due to increased chromium content results from a simultaneous action of chromium in slowing active state diffusion while speeding up the passivation process and increasing the cathode overpotential in nitric acid reduction. An increase of nickel content produces an opposite effect on corrosion and electrochemical behavior. (R.V.J.)

24515

ON THE CORROSION OF ALUMINUM IN THE REACTOR. II. WATER CHEMISTRY OF IN-PILE LOOP. Sueo Nomura (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 2, 468-73(1960) Aug. (In Japanese)

Induced activity and property change, such as electric conductivity, pH value, and oxidation potential, of loop water in an in-pile corrosion test loop were measured and analyzed. The activity of loop water was found to be mainly caused by N^{16}, but γ rays from Cu^{64} and Mn^{56} became powerful after reactor shut down. Electric conductivity of continuously demineralized water in the loop fluctuated with reactor power, but that of non-demineralized water decreased with time and did not return to its initial value even after reactor shut down. The pH value of loop water was much affected by fluid or reactor condition. The oxidation potential of loop water at 50°C dropped or rose under reactor irradiation whether the water was continuously demineralized or not. The amount of dissolved oxygen in water and the amount of hydrogen generated were also measured; H_2O_2, which was expected to be generated by radiolysis of loop water, was not detected in flowing water at 70°C under reactor operation. (auth)

24516

MAGNESIUM OXIDATION AT HIGH TEMPERATURE. REPORT I, II. I. G. Murgulescu and D. Cismaru. Rev. chim. Acad. rép. populaire Roumaine 3, 177-89(1958). (Translated from Referat. Zhur. Khim. No. 19, 1959, abstract No. 67303).

The kinetics of magnesium corrosion in O_2, CO_2, and N_2 atmospheres at 520 to 580°C was investigated. It was established that magnesium oxidation in dry and moist O_2 led to the formation of a MgO film and obeyed the linear time law. Magnesium oxidation in CO_2 took place only when the surface was specially treated (except for a certain initial period), and it obeyed the parabolic law. Oxidation in moist CO_2 gave no reproducible results. Corrosion in dry N_2 led to the formation of a Mg_2N_3 film and obeyed the parabolic law, and in wet N_2, magnesium corrosion obeyed the linear law. The maximum magnesium corrosion rate was observed in CO_2, the minimum rate was observed in N_2. The presence of water vapor in CO_2 increased the oxidation rate markedly; in the case of oxidation in N_2 or O_2, the presence of H_2O vapors speeded the reaction. The corrosion rate obeyed the Arrhenius temperature relationship. The energies of activation of magnesium oxidation (cal/

mole) are 47,920 in dry O_2, 41,130 in wet O_2; 39,780 in dry N_2, 36,090 in wet N_2; and 37,150 in dry CO_2.

24517
THE CORROSION OF REACTOR MATERIALS UNDER THE EFFECT OF RADIATION AND OF THE ACTION OF COOLING AGENTS. E. Miler. Teknika (Belgrade) 13, 241-4(1958). (Translated from Referat. Zhur. Khim. No. 22, 1959, abstract No. 78897).

The literature is reviewed on the mechanism of the corrosion and the effect of lattice changes on the mechanical and electrical properties of reactor materials exposed to the action of radiation and of cooling agents. 10 titles are listed.

24518
THE PROBLEM OF THE GASEOUS CORROSION MECHANISM OF THE Mg–Al–Zn–Mn TYPE MAGNESIUM ALLOYS. I. A. Makolkin (Plekhanov Inst. of National Economy, USSR). Zhur. Priklad. Khim. 33, 1572-80(1960) July. (In Russian)

Electron diffraction, spectral and chemical analysis, and x-ray diffraction were used for the study of the mechanism of the gaseous corrosion of magnesium and Mg–Al–Zn–Mn alloy, designated as ML-5. The corrosive behavior of these metals is of interest for the development and the heat treatment of temperature-resistant magnesium alloys. It was found that up to 400°C, only MgO film is formed; the absence of Al_2O_3 or of the spinel $MgO \cdot Al_2O_3$ can be explained on the basis of the different mobilities of the aluminum and magnesium atoms and ions. The corrosion mechanism in this range is based on the diffusion of magnesium throughout the corrosion products, the reaction zone being located at the exterior surface of the oxide film. Above 400°C the oxidation process becomes linear, being caused by the mutual diffusion of both oxygen and magnesium. The reaction takes place at the surface of the metal and within the film. The other oxides formed during the oxidation reaction in air, such as Al_2O_3, ZnO, and Mn_3O_4 have a lower free energy of formation than MgO and therefore the metallic magnesium is able to reduce them according to the equation $Mg + MeO = MgO + Me$, thus preventing the formation of a film. Heating the alloy in a mixture containing air, CO_2, and SO_2 results in the formation of a protective film containing oxides, sulfates, and carbonates of the metals. This film makes it possible to carry out the heat treatment at 425°C. (TTT)

24519
CORROSION OF IRON IN MOLTEN NITRATES AND CHLORIDES OF GROUP I AND II METALS OF THE PERIODIC TABLE. V. P. Kochergin, E. P. Druzhinina, G. V. Men'shenina, and E. P. Asanova (Gorkiĭ Ural State Univ., USSR). Zhur. Priklad. Khim. 33, 1580-6(1960) July. (In Russian)

The corrosive behavior of iron in the molten-salt mixtures of $NaNO_3$–$MgCl_2$, $NaNO_3$–$ZnCl_2$, $NaNO_3$–LiCl, $NaNO_3$–KCl, $Ca(NO_3)_2$–NaCl, $Sr(NO_3)_2$–NaCl, $Ba(NO_3)_2$–NaCl, and KNO_3–NaCl was investigated in order to provide the necessary theoretical background for choosing suitable molten-salt mixtures for use as a flux, heat-transfer agent, or heat-treating medium. It was found that the corrosion rate increases with increasing chloride content of the melt, with the chloride ions playing the role of activator in the nitrate–chloride mixtures. Removal of residual water at high vacuum at 400°C results in a lowering of the corrosion rate; however, an opposite behavior was observed in the $Ca(NO_3)_2$–NaCl mixtures. This is explained by the decomposition of the nitrate and the interaction of the iron with the chemically active nitrite, according to the equation $9Fe + 4Ca(NO_2)_2 = 4CaO + 3Fe_3O_4 + 4N_2$. (TTT)

Fabrication

24520 59-RL-2281 M
General Electric Co. Research Lab., Schenectady, N. Y.
SLIP CASTING METALS. P. D. S. St. Pierre. Sept. 1, 1959. 18p.

The process of slip casting metal powder is described and compared with ceramic practice. The physicochemical relationships between powder and vehicle are discussed, and the implications of the phenomena observed are related to the technology. (auth)

24521 ANL-5724
Argonne National Lab., Ill.
THE MANUFACTURE OF CENTRIFUGALLY CAST ALLOY FUEL SLUGS (MARK-II FUEL LOADING FOR EBR-I). Work Completed: October 1953. F. L. Yaggee. July 1960. 38p. Contract W-31-109-eng-38. OTS.

The fabrication of the Mark-II fuel loading for EBR-I, consisting of a U-2 wt.% Zr alloy, is described. Fuel slugs measuring 0.383 in. in diameter were centrifugally cast to size in massive Cu molds. The resulting microstructure was characterized by a fine grain size and a completely random grain orientation not easily obtained in wrought fissile material of comparable composition, even after heat treatment. Reproducibility of the desirable as-cast structure and physical properties of the fuel slugs was automatic. On thermal cycling in NaK in the temperature range from 50 to 550°C, the resulting fuel slugs exhibited negligible growth, even after 570 cycles. The gross weight of the 477 alloy fuel slugs produced in 31 productive melts was 67,199.6 g. The over-all process yield was 91.71%. These fuel slugs were loaded into 227 fuel rods for shipment to EBR-I. (auth)

24522 HW-63166
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CASTING ALUMINUM–PLUTONIUM ALLOYS. C. H. Bloomster. Mar. 21, 1960. 19p. Contract AT(45-1)-1350. OTS.

The casting of aluminum-20 wt. % plutonium alloys in air within a dry box is described. Aluminum–plutonium billets that require no surface machining were produced for coextrusion cladding. A metallurgical bond was obtained between the cast surface of the fuel and the cladding. Studies on the reduction of PuO_2 with aluminum to an aluminum-1.8 wt. % plutonium alloy gave satisfactory results. (C.J.G.)

24523 K-1456
Oak Ridge Gaseous Diffusion Plant, Tenn.
GAS SHIELDED ARC WELDING PROCESSES. J. Maginnis. Sept. 7, 1960. 13p. Contract W-7405-eng-26. OTS.

Various types of gas-shielded arc-welding processes are compared by means of tables and graphs which show their characteristics, welding applications to which they are best suited, expected results, and cost comparisons with coated-metal arc-welding processes. (C.J.G.)

24524 NAA-SR-5144
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
PROCESS DEVELOPMENT AND FABRICATION OF Th–7.6 WT % U FUEL ELEMENTS FOR THE SECOND CORE LOADING OF THE SODIUM REACTOR EXPERIMENT. J. A. Stanley and M. H. Binstock. Sept. 15, 1960. 30p. Contract AT-11-1-GEN-8. OTS.

The second core loading for the Sodium Reactor Experiment (SRE), consisting of 45 seven-rod fuel clusters, was fabricated. A process was developed to fabricate 0.750-in. diameter by 6.000-in. long slugs of Th–7.6 wt. % U alloy. The NaK bonding of slugs to stainless-steel cladding was successfully accomplished. (auth)

24525 NOR-60-272
Norair. Div. of Northrop Corp., Hawthorne, Calif.
PROGRAM FOR THE DEVELOPMENT OF EXTRUDED BERYLLIUM SHAPES. Interim Engineering Report No. 9 [for] June 1, 1960 through August 31, 1960. 11p. Contract AF33(600)-36931.

This report documents and summarizes a portion of the total effort of the Beryllium Extrusion Development Program, Phase I. The work reported herein is part of an extension to Phase I in which the major problems of beryllium extrusion are being thoroughly investigated. Northrop Corporation, Norair Division, the prime contractor, and Nuclear Metals, Inc., the subcontractor, are working in close association to achieve project objectives. Feasibility of unclad beryllium extrusion was demonstrated in Phase I proper, but additional work was considered necessary to perfect extrusion methods. 20-ft lengths of extruded shapes are desired; 5- to 6-ft shapes were made in Phase I proper; 10- to 12-ft lengths of defect-free material have now been realized; and efforts are now being directed toward method development for the 20-ft-long Phase I channel-shaped extrusions. Extrusion #135 resulted in a 26-ft-long extrusion with only a few defects and thus represents the best effort to date. It has not, however, been possible to establish a reasonable degree of consistency. Because of the rather low top speed of the press and the marginal tonnage available at its top speed, efforts are being made to have an exploratory extruding effort performed under Nuclear Metals' auspices at another facility. (auth)

24526 NP-9060
California. Univ., Berkeley. Minerals Research Lab.
INVESTIGATION OF FEASIBILITY OF FABRICATING DUCTILE CERAMICS. First Annual Report. T. H. Hazlett. May 1960. 16p. Contract NOas 59-6056-c.

The feasibility of using metal-forming procedures such as extrusion, rolling, and forging for the shaping of polycrystalline aggregates of cubic ionic solids was studied. LiF extrusions (0.165 in. in dia.) were formed at 500°C under a pressure of 120,000 psi. The extrusions were quite transparent in the center but were usually surrounded by an opaque surface approximately 0.010 in. thick. (C.J.G.)

24527 NUMEC-P-20
Nuclear Materials and Equipment Corp., Apollo, Penna.
DEVELOPMENT OF PLUTONIUM BEARING FUEL MATERIALS. Progress Report for January 1 through March 31, 1960. 36p. Contract AT(30-1)-2389. OTS.

Construction of the NUMEC Plutonium Facility was essentially completed. Methods for the preparation of Pu, U, and Th oxides of high purity and the fabrication of these materials into fuel shapes is discussed. (For preceding period see NUMEC-P-10.) (W.L.H.)

24528 ORO-313
Clevite Corp. Mechanical Research Div., Cleveland.
FUEL BEARING FIBERGLAS IN ALUMINUM BASE FUEL ELEMENTS. Monthly Progress Letter No. 14, [for] Period July 1, 1960 to July 31, 1960. R. H. Baskey. Aug. 16, 1960. 3p. Contract AT(40-1)-2557. OTS.

The objective of the program is to develop procedures which utilize Al-coated fuel-bearing Fiberglas as core material in Al-clad fuel elements. Twenty-four depleted U-bearing Fiberglas compacts were vacuum hot-pressed. The majority of these compacts were cut into two equal pieces for use as core sections. (For preceding period see ORO-304). (W.L.H.)

24529 SCNC-273
Sylvania-Corning Nuclear Corp., Bayside, N. Y.
DISPERSION TYPE MATERIALS FOR FUEL ELEMENTS. PART II. URANIUM CARBIDE AND URANIUM SULFIDE DISPERSION MATERIALS. I. Sheinhartz. Mar. 1959. Decl. May 13, 1960. 16p. Contract AT-30-[1]-GEN-366. OTS.

The feasibility of UC$_2$ and US$_2$ use as dispersants in matrices of Mo, Nb, Nb–Ti alloy, V, Zr, and Al for matrix-type fuel elements was investigated. At the fabrication temperature of 1200°C, UC$_2$ reacted with more or less all the matrix materials under investigation, whereas US$_2$ appeared to be a more promising dispersant material. Zircaloy-2 prepared by powder metallurgy was compared with conventionally prepared Zircaloy-2, but, owing to improper equipment, the tests did not present any positive conclusions. (See also SNCNC-266.) (auth)

24530 TID-6339
General Atomic Div., General Dynamics Corp., San Diego, Calif.
PREPARATION OF UC$_2$–ThC$_2$—GRAPHITE FUEL BODIES FOR THE GA-308 HTGR CAPSULE IRRADIATIONS. W. V. Goeddel. Sept. 14, 1959. 24p. Project No. 32. Contract AT(04-3)-314. (GAMD-973). OTS.

The fabrication of dispersion type fuel bodies consisting of ThC$_2$–UC$_2$ particles in a graphite matrix for capsule irradiation tests is described. (C.J.G.)

24531 AEC-tr-4065
ON THE VACUUM HOT PRESSING OF HIGH GRADE BERYLLIA. Katsuzo Kida, Mitsunobu Abe, Susumi Nishigaki, and Seiichi Imura. Translated from J. Atomic Energy Soc. Japan 1, 259-71(1959). 21p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 2708.

24532 JPRS-5081(p.1-18)
ARC MELTING OF REFRACTORY METALS AND ALLOYS UNDER LABORATORY CONDITIONS. A. I. Evstyukhin (Yevstyukhin), G. A. Leont'ev (Leont'yev), and V. V. Nikishanov. Translated from Met. i Metalloved. Chistykh Metallov, No. 1, 106-21(1959).

A method for arc melting refractory metals such as zirconium is presented in which an arc between the specimen in an intensively cooled copper crucible and the electrode is used. The specimen maintains a thin unmelted skin in contact with the crucible. Owing to this interface there is no reaction between the melted specimen and crucible. The design of a universal laboratory arc furnace for use in this work is described. (J.R.D.)

24533
EFFECT OF X-RAY ON FORMATION AND GROWTH OF HOOKWORM LARVAE. A. K. Bandyopadhyay, S. P. Basu, and A. B. Chowdhury. Bull. Calcutta School Trop. Med. 8, 62-3(1960) Apr. (In English)

Preliminary observations indicate that under these experimental conditions, x radiation accelerated the rate of larvae development and resulted in the early attainment of the infective filariform stage. (C.H.)

24534
TYPICAL ASPECTS IN THE USE OF WELDING IN NUCLEAR REACTORS. Michele Patti. Ing. nucleare 3, 20-35(1960) Jan.-Feb. (In Italian)

The importance of welding processes in the construction of nuclear reactors is pointed out, and an examination is made of the peculiarities of certain metals and alloys, the use of which has become necessary as a result of the severe physical and chemical operating conditions and because of specific nuclear requirements. In view of the fact that the majority of the alloys in question react to atmospheric gases, welding processes must be carried out in an inert-gas atmosphere, using special techniques and devices. These techniques are described and an analysis is made of the equipment necessary to make them possible. An examination is made of the techniques described with particular reference to the manufacturing of fuel elements for various types of reactors. (auth)

24535

PREPARATION OF ISOTOPE TARGET FOR NUCLEAR STUDIES. A. D. Bondar, A. S. Emlyaninov, A. P. Klyucharev, L. G. Lishenko, V. N. Medyanik, A. D. Nikolaichuk, and O. E. Shalaeva (Inst. of Physics, and Tech., Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 929-33(1960) July.

The preparation of foils of 16 metals by electrolytic precipitation, evaporation in vacuum by direct heating, and thermal dissociation methods is described. Foils of Ni, Cu, Zn, Cd, Co, Mn, Fe, Ag, Cr, Pb, and Sn were prepared by electrolytic precipitation, Ge and Be foils were prepared by evaporation in vacuum, and Zr, Ti and Cr foils were prepared by thermal dissociation. Descriptions are given of the apparatus for preparing titanium, zirconium and chromium iodides by the thermal dissociation method. The prepared isotopic targets retained most of their qualities after repeated bombardment by 5.5, 6.8, and 20-Mev protons. (R.V.J.)

24536

ALUMINUM WELDING AND MANIPULATION. SWEDISH METHODS. U. Alfredsson. Nuclear Eng. 5, 405-8(1960) Sept.

Swedish methods used in welding aluminum are discussed. Pure aluminum was chosen for the reactor vessel and storage tank of the RO reactor. Special tools were designed to insure the close tolerances necessary in welding the reactor tank. Aluminum was also used in the R-2 reactor. Methods are described for welding the lower outlet, the pool liner, pipes, and tanks. The requirements which had to be met included no cracks, no lack of fusion, no undercuts, no impurities, no pores greater than $^{1}/_{16}$ in., and a smooth surface without ridges or drops. (M.C.G.)

24537

IMPROVEMENTS RELATING TO THE FORMATION OF EXTERNAL FINS ON METAL TUBE STOCK. George Thomas Maughan (to Fairey Co., Ltd.). British Patent 838,984. June 22, 1960.

A method is given for forming fins on metal tube stock. It consists of enclosing a heated tube in an external tubular die of which the internal surfaces are formed with recesses in the desired fin pattern. The recesses are filled by the use of an expander plug of which the diameter is slightly greater than the original bore of the tube. Magnox may be used as the metal tube. This method is particularly useful for making finned tubes for heat-exchange purposes in reactors. (D.L.C.)

24538

PROTECTIVELY COVERED ARTICLE AND METHOD OF MANUFACTURE. (to United Kingdom Atomic Energy Authority). British Patent 842,441. July 27, 1960.

A method is described for coating metal objects of tubular shape with hermetic metal coatings without discontinuities such as are caused by supporting stringers. The method also is suitable for coating uranium rods or cylinders with aluminum-silicon alloys having good heat-conducting bonds with the uranium. The ends of the tubular body are fitted with end caps of the coating metal having projecting rims, and the body is placed in a casting die, the end caps supporting and centering the body so that stringers are not needed. Molten coating metal is then cast about the body, and the rims of the end caps melt to form a bond between the end caps and the cast metal. (D.L.C.)

24539

IMPROVEMENTS IN OR RELATING TO THE DEPOSITION OF NICKEL COATINGS. Leslie William Owen (to United Kingdom Atomic Energy Authority). British Patent 843,531. Aug. 4, 1960.

A method and apparatus are described for coating objects (especially uranium) with nickel; nickel coatings well over 0.1-in. thick can be obtained. The object to be coated is supported in a bell jar evacuated to a pressure $< 10^{-2}$ or 10^{-3} mm Hg and heated to effect partial removal of adsorbed gases; a stream of nickel carbonyl vapor is fed in such a way that the pressure in the bell jar never exceeds 10 mm Hg and preferably is 1 to 3 mm Hg. A second metallic object can be placed near the first object and heated so that oxidation or nitridation, if any, occurs first on the second object. In the case of uranium, after coating with nickel, it can be heated to improve coating adhesion by interdiffusion of the nickel-uranium interface. (D.L.C.)

24540

IMPROVEMENTS IN AND RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Andrew Thomson Bowden (to C. A. Parsons and Co., Ltd.). British Patent 845,913. Aug. 24, 1960.

Fuel elements in containers with welded end closures can be fabricated in such a way that stresses in the weld owing to differential expansion are greatly reduced. The fabrication consists of inserting a fuel element into a container in such a manner that the ends protrude beyond the element, end-closure members are then inserted into the protruding parts of the container. Closure is effected in the following way: Recesses are formed in one of the mating surfaces of the protruding parts and the other surface is caused by pressure to mold into the recesses, forming an interlock whereby the container and the end-closure members expand together. The top edges of the mating surfaces are then welded together. If the container and end-closure material is a magnesium alloy, the recess-containing surface may be hardened by anodizing. However, a non-hardened region must be left between the recess and the weld in order to ensure a good weld. (D.L.C.)

24541

PRODUCTION OF SHAPED BORON BODIES. Peter Best and Tom Thorpe (to United Kingdom Atomic Energy Authority). British Patent 846,292. Aug. 31, 1960.

Boron powder can be formed into bodies suitable as neutron absorbers in reactors, e.g., slugs, by pressing a mixture containing ~10% of a metal in a graphite die under a pressure of 1 ton/sq in. at 1900°C. The metal may be one with an atomic number in the range 24 to 29, usually Ni, Mn, Cu, Al, and Si, for which examples are given using a graphite die lined with boron nitride to prevent B_4C formation. The particle size of both boron and metal powders should be $\sim 5\mu$. The density of boron in the slugs is high, in the range 97 to 100% theoretical density. Slugs containing niobium and manganese are less brittle than other slugs; slugs containing aluminum are the most brittle. (D.L.C.)

24542

NUCLEAR REACTOR FUEL ELEMENT. Arthur Gray

Robson (to C. A. Parsons & Co., Ltd.). British Patent 846,330. Aug. 31, 1960.

Fuel elements for graphite-moderated gas-cooled reactors, which are capable of operation above 600°C and which are nontoxic, can be fabricated. They comprise uranium oxide or uranium carbide fuel housed in a sealed container made of aluminum oxide sintered at 1000 to 1500°C. The advantages of the container material are given; although it is not ductile, fuel swelling can be taken up by leaving a gap between the fuel and the container. (D.L.C.)

Properties and Structure

24543 AFOSR-TN-60-695
Franklin Inst. Labs. for Research and Development, Philadelphia.
PROPERTIES OF ZONE REFINED TITANIUM — PART II. Interim Report. G. Spangler and M. Herman. July 1960. 38p. Contract AF18(600)-1581. (I-A1878-7).

The recrystallization characteristics, grain growth kinetics, residual resistivity ratio, and mechanical deformation characteristics of zone refined titanium are presented and discussed. The ultimate purification and the redistribution of impurities in the zone refined material were evaluated in terms of these operational parameters. The effects of purity and grain size on the tendency for discontinuous plastic flow at 4.2°K are also examined. (auth)

24544 AFOSR-TR-60-116
Michigan. Univ., Ann Arbor. Coll. of Engineering.
THE EFFECT OF SURFACE TENSION OF A LIQUID METAL ENVIRONMENT ON THE FRACTURE STRENGTH OF SOLID METALS. D. A. Kraai, S. Floreen, C. A. Stickles, D. V. Ragone, and E. E. Hucke. July 1960. 302p. Contract AF49(638)-422. (UMRI-2782-1-F).

The variation of the fracture strength of solid copper wire was investigated as a function of the interfacial free energy between the specimen and its liquid-metal environment. In other work, the changes in surface free energy of a solid in strain were investigated. Experiments were also conducted to determine the effect of applied stress on dihedrial angles of liquid lead in copper at 900°F. Results of these investigations are presented in three sections, each of which contains its own introduction, body, conclusions, references, and pagination. (J.R.D.)

24545 ANL-6096
Argonne National Lab., Ill.
THE ADIABATIC ELASTIC MODULI OF SINGLE-CRYSTAL ALPHA URANIUM AT 25°C. Work completed: January 1958. Partial Report—Metallurgy Program 4.1.16. E. S. Fisher. June 1960. 91p. Contract W-31-109-eng-38. OTS.

The 9 single-crystal elastic moduli pertaining to principal crystallographic axes of alpha U at 25°C were determined from measurements of high-frequency wave velocities for 21 modes in seven single-crystal specimens, using the phase-comparison method of McSkimin. From the results the elastic compliances, compressibilities, and Poisson's ratios were computed for the principal axes. The variations with crystal direction of the stiffness moduli, Young's moduli, and rigidity moduli were plotted. The nature of the anisotropy for the different moduli indicated that the nearest neighbor interatomic bonds are considerably stiffer than the next nearest bonds, which are only slightly larger in interatomic distance. (auth)

24546 CRFD-933
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE EFFECT OF 4 mol% Y_2O_3 ON THE THERMAL CONDUCTIVITY OF UO_2. J. A. L. Robertson, A. S. Bain, and A. Ridal. June 1960. 17p. (AECL-1037). AECL.

To compare the thermal conductivity of UO_2−4 mol% Y_2O_3 to that of pure UO_2, duplicate specimens of each were irradiated under identical conditions in the Hydraulic Rabbit of the NRX reactor. Although the heat ratings of the specimens containing Y_2O_3 were marginally smaller, these specimens exhibited an appreciably larger molten zone. Thus the addition of 4 mol% Y_2O_3 does not improve the mean thermal conductivity of UO_2 over the temperature range 350 to 2800°C. (auth)

24547 DMIC-133
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
TANTALUM AND TANTALUM ALLOYS. F. F. Schmidt. July 25, 1960. 332p. Contract AF18(600)-1375. (PB-151091). OTS.

A descriptive literature survey was made covering physical properties, process metallurgy, binary and ternary alloy systems, chemical properties, and metallurgical properties of Ta and Ta alloys. The properties of Ta are well reported; however, investigations concerned with the effects of interstitial and substitutional alloying elements on the properties of Ta are limited. Tantalum has only moderate strength at room temperature; however, the elevated-temperature strength decreases slowly in comparison with that of many other metals. The low ductile-to-brittle behavior, excellent fabricability, high melting point, and high solubility for interstitial and substitutional elements make Ta an attractive candidate for use in high-temperature high-strength alloys. Refractory metals that exhibit brittle behavior at room temperature, such as Mo and W, can be alloyed with Ta to form Ta-base alloys with a combination of high-temperature strength and low-temperature ductility not found in many metallic materials designed for ultra-high-temperature service. 287 references. (auth)

24548 DMIC-Memo-62
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
THE EFFECT OF RATE OF HEATING TO AGING TEMPERATURE ON THE TENSILE PROPERTIES OF Ti−2.5Al−16V ALLOY SHEET. G. S. Root and H. R. Ogden. Aug. 18, 1960. 12p. OTS.

Tensile properties of aged titanium—2.5 wt. % aluminum—16 wt. % vanadium, heated to aging temperature at various rates, were correlated with a quench and reheat time-temperature-transformation diagram. A definite effect was determined which is directly associated with the low-temperature path of the heating curve. The production of ω phase by a low-temperature isothermal treatment did not produce high strength. (C.J.G.)

24549 HW-59941
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ETR-MTR EXPERIMENTS ON RESTRAINT OF URANIUM SWELLING BY ZIRCONIUM CLADDING. J. W. Weber. Apr. 10, 1959. 16p. Contract AT(45-1)-1350. OTS.

Test apparatus and procedures to determine the effects of cladding and core temperatures, cladding thickness, and exposure upon the swelling behavior of uranium clad with Zircaloy-2 are described. (C.T.G.)

24550 LAMS-2437
Los Alamos Scientific Lab., N. Mex.
ON A METHOD OF MEASURING DIFFUSION COEFFICIENTS FOR FISSION PRODUCTS IN POWDERED OR SINTERED MATERIALS. Leston Miller. June 24, 1960. 14p. Contract W-7405-eng-36. OTS.

It is shown that the diffusion of fission products out of irregularly shaped particles in which the initial concentration is uniform is approximately independent of particle shape during the early stages of the diffusion process. The concentration is shown to depend only on distance measured into the particle normal to the surface and on time; therefore, the diffusion is initially one-dimensional. The one-dimensional diffusion equation with a time-dependent diffusion coefficient is solved with appropriate boundary conditions. Application of the solution to the experimental determination of diffusion coefficients is discussed. (auth)

24551 LMSD-288140(Vol. II)(Paper 1)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
ELECTRONIC STRUCTURE OF BERYLLIUM. G. C. Kuczynski. Paper 1 of GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME II. 26p.

This paper is a reprint from LMSD-288003, dated Aug. 1959.

An attempt is made to correlate the structure-insensitive physical properties of beryllium on the basis of the theory of solids. Special attention is paid to the thermal, elastic, and electrical properties. An explanation of the decrease of lattice parameters ratio with temperature is proposed based on the Herring-Hill calculations of the wave functions for beryllium. Recommendations are made for experimental work toward the increase and completion of the information concerning the physical properties of beryllium. (auth)

24552 LMSD-288140(Vol. II)(Paper 3)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
PLASTIC DEFORMATION IN BERYLLIUM. E. C. Burke. Paper 3 of GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME II. 17p.

The gross growth structure on electrodeposited beryllium crystals is rationalized on the basis of a Crova disk construction. Beryllium undergoes large amounts of accommodation kinking on the $\{11\bar{2}0\}$ planes without cracking. Evidence is presented that beryllium may twin on planes other than $\{10\bar{1}2\}$. The stereographic projection for beryllium is presented in a standard orientation. (auth)

24553 LMSD-288140(Vol. II)(Paper 8)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
SPECIFIC HEATS OF BERYLLIUM AND AN ALLOY AT ROOM AND ELEVATED TEMPERATURES. E. Kanazawa and C. M. Packer. Paper 8 of GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME II. 21p.

This paper was originally published under the same title as LMSD-2702, dated Feb. 11, 1958.

The heat content equation for an alloy for the range 80 to 1000°F was determined to be $\Delta H = -3.01 + 0.0981T + 12.26 \times 10^{-6}T^2$. The heat content equation for brush QMV beryllium for the range 80 to 2000°F was determined to be $\Delta H = -20.87 + 0.561T + 8.36 + 10^{-5}T^2$. The calorimetric method with a standard specimen was used in the investigation. In order to measure the experimental error, the heat content of a nickel standard was determined using an iron standard. The maximum deviation over a series of temperatures was found to be 2.7%. (auth)

24554 NAA-SR-Memo-4854
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
POST SERVICE METALLURGICAL EXAMINATION OF GRISCOM-RUSSELL TWO-TUBE SUPERHEATER. J. P. Page. Jan. 14, 1960. 5p. OTS.

Studies were made to determine the suitability of 5% chromium, 0.5% molybdenum, titanium steel as a structural material for the Hallan superheater. Magna-glow, radiographic, and metallographic examinations of the welds, core tubes, and heat-transfer tubes revealed no harmful effects resulting from the service test. (M.C.G.)

24555 NP-8872
Research Chemicals, Inc., Burbank, Calif.
REFRACTORY GADOLINIUM AND HAFNIUM COMPOUNDS. Monthly Report for the Period October 1 to October 31, 1959. 5p. Contract NObs-77145. (RC-122).

Seebeck coefficients were obtained for gadolinium compounds containing antimony, bismuth, and silicon at 30, 100, and 200°C. Melting points were obtained for all compounds. Preliminary data on Seebeck coefficients and melting points of gadolinium-phosphorus compounds are presented. (C.J.G.)

24556 NP-8965
Ohio State Univ. Research Foundation, Columbus.
STRESSES IN POLYCOMPONENT SOLID CERAMICS OR CERMETS. Final Summary [for] February 1, 1959 to January 31, 1960. Thomas M. Giles, Thomas S. Shevlin, and J. O. Everhart. Dec. 1959. 19p. RF Project No. 806. Contract AF33(616)-5515.

Internal stresses in a ceramic-ceramic biaxial model were calculated from elastic constants and thermal-expansion data, and the stress levels were correlated with the transverse strengths. A method for accurate thermal-expansion measurement with a fused-quartz tube dilatometer was perfected and results were given. (auth)

24557 NP-8973
General Electric Co. Flight Propulsion Lab. Dept., Cincinnati.
THE EFFECT OF ARC PLASMA DEPOSITION ON THE STABILITY OF NON-METALLIC MATERIALS. Bimonthly Report No. 2 covering period May—June 1960. B. E. Kramer and M. A. Levinstein. Aug. 3, 1960. 9p. Contract NOas-60-6076-C. (DM-60-174).

Various high-melting-point carbides, oxides, nitrides, and borides were flame sprayed with a plasma-jet spray gun. Chemical and crystallographic analyses were made to determine the stability of the materials. Much of the spraying was done in a controlled environment. (auth)

24558 NP-8986
Quartermaster Research and Engineering Center, Natick, Mass.
THE OPTICAL AND MECHANICAL PROPERTIES OF HIGH POLYMERS. Research Report No. 14—High Polymer Series. A Series of Lectures by Professor Richard S. Stein (Univ. of Massachusetts), Joseph D. Loconti, Nathaniel S. Schneider, and Harold W. Coles, eds. Mar. 1960. 282p.

The information reported is derived from a series of ten 2-hr lectures. The lectures covered the following subjects: statistics of chain configurations, kinetic theory of rubber elasticity, birefringence of rubber-like networks, flow of amorphous networks in the rubbery state, molecular theories of relaxation time distribution, the glassy state, the crystalline state, measurement of orientation in crystalline polymers, mechanical properties of crystalline polymers, and ultimate mechanical properties of polymers. (W.L.H.)

24559 NP-9028
Marquardt Aircraft Co., Van Nuys, Calif.
PERFORMANCE OF MATERIALS AT ELEVATED TEMPERATURES FOR AIRCRAFT AND MISSILE APPLICATIONS. Alan V. Levy. [195?]. 34p. (MP-595).

Properties of alloys for high-temperature use in aircraft and missiles are discussed. Alloys of Al, Mg, Mo, and Ti; stainless and alloy steels; and high-temperature Fe, Ni, and Co base alloys are examined. It is noted that the melting temperatures of materials provide an impenetrable wall in structure performance which must be climbed over by artificial cooling rather than passed through by further material development. (J.R.D.)

24560 NP-9030
Battelle Memorial Inst., Columbus, Ohio.
FURTHER STUDIES ON RHENIUM ALLOYING EFFECTS IN MOLYBDENUM, TUNGSTEN, AND CHROMIUM. W. D. Klopp, F. C. Holden, and R. I. Jaffee. July 12, 1960. 34p. Contract Nonr-1512(00).

Further studies on molybdenum-rhenium alloys indicate that the improved fabricability is associated with redistribution of the grain-boundary oxide as a complex rhenium-molybdate. The tolerance for oxygen in Mo-35Re is several hundred ppm, but small increases in carbon or nitrogen render the alloy less fabricable. The contribution of valence electrons from rhenium to the molybdenum lattice is believed to be associated with the reduced interstitial solubility. The improved ductilities of Mo-35Re and W-30Re are associated with lower interstitial content, enhanced capacity for slip at low temperatures, and low critical stresses for deformation by twinning, which appears to be a function of rhenium content alone. Rhenium also significantly lowers the ductile-to-brittle transition temperature of chromium to below −196°C in bending. (auth)

24561 NP-9069
[Japan].
SEVERAL PROPERTIES OF METALLIC URANIUM. Report No. 1. 1957. 61p.

Properties of metallic uranium in various forms were investigated up to 1250°C. (C.J.G.)

24562 NP-9192
California. Univ., Berkeley. Materials Research Lab.
DEFORMATION TWINNING AND FRACTURE IN MOLYBDENUM. Technical Report No. 21. F. O. Mueller and E. R. Parker. June 1960. 31p. Contract Nonr-222(52).

The relationship between deformation and fracture in neighboring grains of polycrystalline metals was investigated. Compression tests on specimens cut from a molybdenum ingot were conducted at room temperature and at −190°C. A discussion of results which reveal the interrelations between slip, twinning, and fracture is presented. (J.R.D.)

24563 TID-6562
Denver. Univ. Denver Research Inst.
STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON—ALUMINUM ALLOYS. Monthly Letter Report No. 9 for March 15, 1959 to March 15, 1960. Frank C. Perkins and Joseph F. Nachman. Jan. 11, 1960. 8p. Contract AT(11-1)-742. OTS.

Initial heat-treatment studies are reported in which the effects of quenching rate upon room temperature ductility of iron-aluminum alloys were investigated. Quenching media included boiling water, oil at room temperature, and oil at 100°C. Experimental results are tabulated. No definite trends in tensile properties were observed with differences in quenching rate. Electropolishing techniques for use in preparation of specimens are discussed in relation to determination of microcrack effects on tensile tests. (For preceding period see AECU-4528.) (J.R.D.)

24564 TID-6564
Denver. Univ. Denver Research Inst.
STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON—ALUMINUM ALLOYS. Monthly Letter Report No. 11 for March 15, 1959 to March 15, 1960. Frank C. Perkins and Joseph F. Nachman. Mar. 7, 1960. 7p. Contract AT(11-1)-742. OTS.

Experiments were continued in which the effect of microstructure variation on the mechanical properties of iron—aluminum alloys was studied. Results of tensile tests are tabulated. Discussions of procedures and results are also included. (For preceding period see TID-6563.) (J.R.D.)

24565 TID-6565
Denver. Univ. Denver Research Inst.
STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON—ALUMINUM ALLOYS. Monthly Letter Report [for] March 15, 1959 to April 30, 1960. Frank C. Perkins and Joseph F. Nachman. Apr. 8, 1960. 4p. Contract AT(11-1)-742. OTS.

Studies designed to correlate iron-aluminum alloy microstructure and heating variables with tensile properties were continued through the report period. All specimens were electropolished prior to tensile testing. Results are presented tabularly. (For preceding period see TID-6564.) (auth)

24566 WCAP-1061
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
DETERMINATION OF SURFACE AREAS OF POWDERS BY GAS CHROMATOGRAPHY. J. V. Derby and B. D. LaMont. June 29, 1959. 12p.

It was reported that surface area is one property which can be measured to predict the sinterability of uranium dioxide powder for fabrication of ceramic type fuel elements. A gas chromatographic technique which was developed for the rapid and accurate determination of surface area of uranium dioxide powders is described. The procedure includes two methods of computation and two methods for standardization and calibration. The precision of the method is illustrated in the text and the accuracy is ± 5%. (auth)

24567 AEC-tr-4172
ROLLING OF URANIUM SHEET AND ITS PROPERTIES. STUDIES ON URANIUM FUEL ELEMENT (2). Kyoaki Taketani, Yoshikata Sasaki, and Masayoshi Kuihara. Translated from J. Atomic Energy Soc. Japan. 1, 319-29 (1959). 19p. OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract No. 2436.

24568 AEC-tr-4195
MAGNETIC INVESTIGATIONS OF BODY-CENTERED CUBIC PHASES IN ALUMINUM WITH Fe-GROUP ELEMENTS. Martin Höhl. Translated from Z. Metallk. 51, 85-95(1960). 29p. JCL.

A study of the effects of temperature on the magnetic susceptibility of body-centered cubic phases in Al systems with Ni, Fe, and Co and Ni—Fe is presented. An evaluation of results based on the valence of the participating transition metals of the "ion model" is included. (auth)

24569 AEC-tr-4197
DATA ON THE MUTUAL BEHAVIOR OF ALKALI METALS. Benno Böhm and Wilhelm Klemm. Translated for Oak Ridge National Lab. from Z. anorg. u. allgem. Chem. 243, 69-85(1939). 41p. (Includes original, 17p.). JCL.

Phase diagrams of binary systems involving Li, Na, K, Rb, and Cs were determined. Interrelationships in the behavior of alkali metals toward each other are discussed. The influence of formation of compounds and solid solutions on the magnetic behavior of alkali-metal alloys was studied. The lattice constants in the systems that formed solid solutions were nearly additive, only a slight contraction was found. (C.J.G.)

24570 AEC-tr-4198

ON THE BEHAVIOR OF LITHIUM TO SODIUM, POTASSIUM, TIN, CADMIUM AND MAGNESIUM. G. Masing and G. Tammann. Translated for Oak Ridge National Lab. from Z. anorg. Chem. 67, 183-99(1910). 37p. (Includes original, 17p.). JCL.

The reactions of Li to Na, K, Sn, Cd, and Mg in a H current were studied. Temperatures of crystal formation were determined. Cooling curves were analyzed. (C.J.G.)

24571 JPRS-5024

PROBLEMS ON THE THEORY OF HEAT RESISTANCE OF ALLOYS. Translation of 14 papers from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural Filial No. 19 (1958). 256. OTS.

A compilation of papers on the metallurgical theory of chromium–iron–nickel-base alloys is presented. Fifteen items for which abstracts were prepared are included. (J.R.D.)

24572 JPRS-5024(p.1-7)

WORK OF THE INSTITUTE OF PHYSICS OF METALS OF THE URAL AFFILIATE OF THE ACADEMY OF SCIENCES USSR, ON THE THEORY OF HEAT RESISTANCE OF ALLOYS. V. I. Arkharov. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, p.3-(?) (1958).

Parameters to be considered in the theory of heat resistance in materials are discussed. The most important of these appear to be the mechanism of high-temperature plastic deformation in monocrystals, the dependence of mechanical properties on the atomic interaction within the lattice, the influence of nonuniformity of real solids on the mechanism of deformation, and the effects of concentration nonuniformity in real solids on their mechanical properties. The status of development in these areas is summarized. (J.R.D.)

24573 JPRS-5024(p.8-34)

HEAT RESISTANCE AND INTERNAL ADSORPTION IN POLYCRYSTALLINE ALLOYS. I. GENERAL CONSIDERATIONS ON THE MECHANISM OF PLASTIC DEFORMATION AT LOW AND ELEVATED TEMPERATURES AND ON INTERNAL ADSORPTION IN SOLID ALLOYS. V. I. Arkharov and M. V. (B.) Yakutovich. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 7-22(1958).

Methods of raising the heat resistance of polycrystalline alloys are discussed. These methods include preventing or encumbering the elementary act of plastic deformation and the prevention of its propagation and development. In another theoretical presentation a method of increasing the heat resistance of alloys by internal adsorption of small quantities of impurities is considered. General conclusions drawn from extensive research are included. (J.R.D.)

24574 JPRS-5024(p.35-66)

THE INVESTIGATION OF IRREGULARITIES IN FRONTAL DIFFUSION OF NICKEL IN POLYCRYSTALLINE FERRUM–CHROMIUM–NICKEL ALLOYS. V. I. Arkharov and S. I. Ivanovskaya, I. P. Polikarpova, and N. P. Chuprakova. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 23-42 (1958).

Diffusion of nickel in chromium–iron–nickel alloys is investigated by studying the diffusion-leading edge through a great number of crystallites and intergranular zones. Methods of diffusional mobility measurement are described and conclusions are discussed. (J.R.D.)

24575 JPRS-5024(p.67-75)

THE INFLUENCE OF INTERNAL ADSORPTION ON THE VARIATION OF THE CRYSTAL LATTICE PARAMETER OF A HEAT-RESISTANT ALLOY AT THE CHANGE OF THE GRAIN SIZE. V. I. Arkharov and A. A. Pen'tina. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 43-7(1958).

A study of chemical and structural nonuniformities of alloys and their effects on plastic deformation was conducted. Iron-base alloys containing chromium and nickel, with various specimens containing molybdenum, niobium, titanium, or titanium dioxide, were used. Results lead to the conclusion that nickel, molybdenum, niobium, and titanium are adsorption-active (horophile) elements. This leads to an increase in chemical nonuniformities in such alloys, which tends to decelerate plastic deformation. (J.R.D.)

24576 JPRS-5024(p.94-104)

THE INFLUENCE OF SMALL ADDITIONS OF TITANIUM, MOLYBDENUM, AND TUNGSTEN ON THE MECHANICAL PROPERTIES OF FERRUM–CHROMIUM–NICKEL ALLOYS. E. S. Yakovleva. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 58-64(1958).

The effects of small quantities of additives such as titanium, tungsten, and molybdenum on the mechanical properties of chromium–iron–nickel alloys at high temperatures was investigated. Short-term and prolonged hardness were used as criteria. The lasting hardness of the alloy was affected similarly by each of the three added elements; the first small addition softens the alloy while further additions add to the hardness. (J.R.D.)

24577 JPRS-5024(p.105-14)

THE DISTRIBUTION OF DEFORMATION IN THE GRAINS OF ALUMINUM AND ALUMINUM–ZINC ALLOYS AT CREEP. E. S. Yakovleva. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 65-70(1958).

Variations in deformation distribution over metal grains of aluminum alloys in relation to the quantity of added zinc were investigated. It was found that small zinc additions cause a reduction in flow rate and little change in the extent of grain-boundary deformation. Further additions of zinc cause an increase in flow rate accompanied by reductions in the extent of localizations at grain boundaries and by an increase in the nonuniformity of deformation inside the grain. (J.R.D.)

24578 JPRS-5024(p.154-90)

CONCERNING SHEARING AND DIFFUSION PLASTICITY IN THE PROCESS OF RELAXATION OF STRESSES. G. N. Kolesnikov and A. I. Moiseev (Moiseyev). Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 101-(?)(1958).

A discussion of stress relaxation is presented. It is noted that the primary reason for relaxation of stresses appears to be the nonuniform and nonsynchronous course of plastic deformation in the material. The rate of plastic deformation was determined experimentally for steel. It was found that under the experimental conditions the predominant role in plastic deformation was played by slip. (J.R.D.)

24579 JPRS-5024(p.191-8)

RELAXATION OF STRESSES AND NONUNIFORM DIFFUSIONAL MOBILITY IN POLYCRYSTALLINE AUSTEN-

ITIC FERRUM–CHROMIUM–NICKEL ALLOYS. V. I. Arkharov, S. I. Ivanovskaya, G. N. Kolesnikov, and A. I. Moiseev (Moiseyev). Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 122-6 (1958).

A comparison of results obtained in testing the diffusion of nickel in austenitic alloys with those obtained in testing relaxation in such alloys is presented. The study revealed that the intergranular zones play a substantial role at high deformation. The mechanical properties of the metal appear to be affected by small positively active admixtures. (J.R.D.)

24580 JPRS-5024(p.199-208)
CONCERNING THE INFLUENCE OF PHASE TRANSFORMATIONS ON THE RELAXATION OF STRESSES. G. N. Kolesnikov and A. I. Moiseev (Moiseyev). Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 127-(?)(1958).

Results are presented of an investigation concerned with relaxation of stresses in chromium–iron–nickel alloys to which titanium was added. Theory and results are discussed. It is noted that phase transformations which occur in metals may show very well in the shape of plotted relaxation curves. It is concluded that a search for heat-resisting and nonrelaxing alloys may be conducted using alloys that have phase transformations occurring with a decrease in specific volume. A deduction of the study is that stress relaxation must be studied in pure elements or alloys not subject to phase transformations. (J.R.D.)

24581 JPRS-5024(p.209-19)
THE INVESTIGATION OF RELAXATION OF STRESSES IN FERRUM–CHROMIUM–NICKEL AUSTENITIC ALLOYS CONTAINING ADMIXTURES OF TITANIUM AND NIOBIUM. M. G. Gaidukov (Gaydukov) and V. A. Pavlov. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 133-9(1958).

Results of a study of stresses in chromium–iron–nickel alloys containing additions of niobium and titanium are presented. Procedures and test materials are discussed, and results are presented graphically. It is noted that the alloying processes in additions of niobium and titanium are complex. The dependence of relaxation intensity on composition and testing conditions is discussed. (J.R.D.)

24582 JPRS-5024(p.220-33)
THE INVESTIGATION OF CREEP IN FERRUM–CHROMIUM–NICKEL AUSTENITIC ALLOYS WITH ADMIXTURES OF TITANIUM, NIOBIUM, AND TUNGSTEN. M. G. Gaidukov (Gaydukov) and V. A. Pavlov. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 140-8(1958).

Results of creep tests on chromium–iron–nickel alloys to which various quantities of titanium, niobium, or tungsten were added are presented. An observed selective distribution of alloying elements in the boundary zones of crystallites strengthens grain boundaries and increases alloy heat resistance. Increasing the concentration of alloying elements to a definite level that is characteristic for the particular element increases its heat resistance; however, further additions result in heat resistance irregularities. Explanations of these irregularities are given. (J.R.D.)

24583 JPRS-5024(p.234-9)
THE INFLUENCE OF SMALL ADMIXTURES OF TUNGSTEN, MOLYBDENUM, TITANIUM, AND NIOBIUM ON THE OXIDATION RESISTANCE OF CERTAIN AUSTENITIC Cr20Ni20- AND Cr20Ni35-TYPE ALLOYS AT TEMPERATURES RANGING FROM 1100 TO 1300°. Z. P. Kichigina (Kichigin). Translated Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial. No. 19, 149-52(1958).

Effects of molybdenum, tungsten, titanium, and niobium on the oxidation of chromium–iron–nickel alloys at 1100 to 1300°C were investigated. It was found that small additions of titanium, molybdenum, and tungsten have very little effect, while niobium reduces oxidation resistance, especially in the presence of these elements. A reduction of oxidation resistance is also noted when a larger quantity of tungsten is added. (J.R.D.)

24584 JPRS-5024(p.240-55)
THE EFFECT OF INTERNAL ADSORPTION ON AGING PROCESSES AND THE VALUE OF THIS EFFECT FOR HEAT RESISTANCE. V. I. Arkharov. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 153-(?)(1958).

A discussion of the alloy-aging process gradation and the effects of this process on heat resistance are presented. A general statement is made that in an aging alloy a local concentration of admixtures may occur in which one will accelerate nucleation of the precipitation phase formation centers initially, but be displaced by a competing, more active admixture, and thereby reduce the supply of the excess component to the growing formation. Widely expanded investigations in this area are recommended. (J.R.D.)

24585 JPRS-5081(p.26-45)
MECHANICAL PROPERTIES OF BINARY AND TERNARY ALLOYS OF ZIRCONIUM WITH TANTALUM AND NIOBIUM AT ROOM AND ELEVATED TEMPERATURES. V. S. Emel'yanov (Yemel'yanov), Yu. G. Godin, and A. I. Evstyukhin (Yevstyukhin). Translated from Met. i Metalloved. Chistykh Metallov, No. 1, 128-43(1959).

The hardness and strength of cast and heat-treated binary and ternary alloys of zirconium with tantalum and niobium at room temperature and above were investigated. Resulting data and conclusions are included. (J.R.D.)

24586 JPRS-5167
PRODUCTION AND PHYSICAL METALLURGY OF PURE METALS. PART VI. I. I. Korobkov, D. V. Ignatov, A. I. Evstyukhin (Yevstyukhin), V. S. Emel'yanov (Yemel'yanov), G. B. Fedorov, F. I. Zhomov, and V. D. Gulyakin. (Translation). 46p. OTS.

Papers are presented in which information on oxidation of zirconium and selected zirconium alloys and diffusion of the components in tin-base alloys containing α and β zirconium is given. Separate abstracts were prepared for each of the three included papers. (J.R.D.)

24587 JPRS-5167(p.1-23)
ELECTRONOGRAPHIC AND KINETIC INVESTIGATION OF THE PROCESS OF OXIDATION OF ZIRCONIUM AND CERTAIN ALLOYS ON ITS BASE. I. I. Korobkov, D. V. Ignatov, A. I. Evstyukhin (Yevstyukhin), and V. S. Emel'yanov (Yemel'yanov). Translated from Met. i Metalloved. Chistykh Metallov No. 1, 144-61(1959).

Results of an electronographic investigation of thin oxide films on Zr, Zr–Al, Zr–Ti, and Zr–Sn alloys are presented. The specimens were heated in air at 200 to 800°C to produce the films. (J.R.D.)

24588 JPRS-5167(p.24-33)
DIFFUSION OF ZIRCONIUM AND TIN IN TIN ALLOYS OF ALPHA-ZIRCONIUM. G. B. Fedorov and F. I. Zhomov. Translated from Met. i Metalloved. Chistykh Metallov No. 1, 162-9(1959).

Results of a study of zirconium and tin in α-solid solutions of these metals are presented. The data indicate that alloying α-zirconium with tin increases the activation energy of zirconium self-diffusion. The increase is approximately proportional to the tin content of the alloy. Alloying zirconium with tin has a similar effect on the tin. (J.R.D.)

24589 JPRS-5167(p.34-45)

DIFFUSION OF ZIRCONIUM AND TIN IN TIN ALLOYS OF BETA-ZIRCONIUM. G. B. Fedorov and V. D. Gulyakin. Translated from Met. i Metalloved. Chistykh Metallov No. 1, 170-8(1959).

The effects of tin addition on diffusion constants in β-solid solutions of tin and zirconium were investigated. Experimental data indicate that the addition of tin considerably increases the energy of activation of zirconium. (J.R.D.)

24590 JPRS-5195(p.18-25)

CHANGES IN PHYSICAL PROPERTIES DURING DECOMPOSITION OF THE β-PHASE IN AN ALLOY OF ZIRCONIUM WITH 15% NIOBIUM. Yu. F. Bychkov and A. N. Rozanov. Translated from Met. i Metalloved. Chistykh Metallov No. 1, 224-30(1959).

A study is described in which physical property changes of alloys with cubic β-phase structure were examined during heating to 900°C and subsequent cooling. A zirconium alloy with 15% niobium was used in the study of the aging process in relation to the dissociation of the metastable β-phase. During heating, the β-phase dissociation passes through a transition phase at 350 to 500°C which is accompanied by considerable increases in elasticity modulus, hardness, and specific electric resistivity, and a decrease of the linear expansion coefficient. (J.R.D.)

24591 JPRS-5195(p.26-42)

EFFECT OF ALLOYING ON YOUNG'S MODULUS OF ZIRCONIUM. Yu. F. Bychkov, A. F. Klimov, A. N. Rozanov, and D. M. Skorov. Translated from Met. i Metalloved. Chistykh Metallov No. 1, 231-43(1959).

A study is described in which the effects of alloying various elements with zirconium on Young's modulus value of this metal were determined. Alloys included in the study were composed of α-zirconium with O, Al, Sn, Ti, and Zr alloyed with elements such as Nb, Mo, and Ta, which produce cubic β-structure at room temperature when hardened from the β range. Zirconium alloys with elements forming intermetallic phases with elements such as silicon and aluminum were also investigated. (J.R.D.)

24592 TT-882

THE KNIGHT SHIFT OF IMPURITIES IN METALS. (Sur le Déplacement de Knight des Impuretés dans les Métaux). E. Daniel. Translated by G. A. Gavrel (National Research Council of Canada) from Phys. and Chem. Solids 10, 174-81 (1959). 20p. NRC or JCL.

Some simplifying assumptions made by Knight to explain the Knight shift of impurities in metals have been justified by a theoretical study. It is shown that one can neglect the polarization of the conductive electrons by the nucleus of an impurity atom; there is also a nearly constant ratio between the wave function at the bottom of the conduction band and the corresponding function for a free atom. The departure of measurements from Knight's empirical formula is often small and of the same order of magnitude as the errors due to the approximation used. (auth)

24593

THE CRYSTAL STRUCTURES OF Zr_5Sn_3 AND Zr_3Sn. Gunnar Gran and Sten Andersson (Univ. of Stockholm). Acta Chem. Scand. 14, 956-7(1960). (In English)

In the tin-zirconium system, four intermediate phases are reported to exist, viz., Zr_4Sn, Zr_5Sn_3, ZrSn, and $ZrSn_2$; crystal structures are given for $ZrSn_2$ and Zr_5Sn_3. Alloys of several compositions were prepared from metallic zirconium and tin of 99.95% purity by melting pressed tablets of the metals in an electric arc furnace under argon. The samples were wrapped in tantalum foils, sealed in evacuated silica tubes, and annealed at 900°C for two months. An indexed powder pattern of $ZrSn_{0.6}$ containing two phases of Zr_5Sn_3 type is tabulated. At a composition $ZrSn_{0.4}$ the Guinier pattern showed, in addition to the pattern of the defective Zr_5Sn_3, a number of strong extra lines. Assuming a cubic unit cell, the extra lines could be indexed with a = 5.634 A, which corresponds to the B-tungsten structure and which should be given the formula Zr_3Sn. (B.O.G.)

24594

THE STRUCTURE OF $NbZn_3$. C. L. Vold (Naval Research Lab., Washington, D. C.). Acta Cryst. 13, 743(1960) Sept.

A study of the Nb-Zn system was initiated to assist in understanding the high temperature oxidation resistance of zinc-coated niobium. The existence of three compounds was indicated. On the basis of weight gain, the composition of the high zinc compound was estimated to be $NbZn_3$; this was confirmed by a structure determination using the x-ray powder method and by chemical analysis. X-ray examinations of samples quenched from 475° and 870°C showed no apparent reduction in the intensities of lines with mixed indices. It is concluded that no order-disorder transformation occurs within the temperature range considered, unless the solid-state diffusion rates are sufficiently rapid to allow the transformation to occur during quenching. (B.O.G.)

24595

SOME LAVES PHASES OF YTTRIUM WITH TRANSITION ELEMENTS. B. J. Beaudry, J. F. Haefling and A. H. Daane (Iowa State Univ., Ames). Acta Cryst. 13, 743(1960) Sept.

The cubic laves phase (C15 type) was found in the phase systems of Y with Mn, Fe, Co, and Ni. Alloys containing 65.0, 66.7, and 68.0 at. % Mn, Fe, Co, and Ni were prepared by co-melting with yttrium in an arc furnace. The alloys were homogenized by annealing in vacuo in silica capsules at 870°C for 125 hr, with the exception of Y-Ni alloys which were annealed at 950°C for 100 hr. The samples were quenched rapidly in water, pulverized, and annealed at 400°C in evacuated Pyrex capsules. X-ray diffraction studies were made on the specimens, and because of the reflection intensities, the relative intensities were calculated for YNi_2. The agreement between observed and calculated intensities for YNi_2 confirms the proposed structure for the compound. Some variation in the observed intensities due to the different dispersion of the CuKα radiation by Ni, Co, Fe, and Mn was noted, but the agreement of the calculated intensities for YNi_2 and observed intensities of YCo_2, YFe_2, and YMn_2 leave little doubt that these compounds are all isostructural. The lattice constants and interatomic distances for the compounds are tabulated. (B.O.G.)

24596

CRYSTALLIZATION FROM DILUTE METAL SOLUTIONS. L. Benjamin and R. F. Strickland-Constable (Imperial Coll. of Science and Tech., London). Acta Met. 8, 362-72(1960) June.

The nucleation and crystal growth from solutions of zinc in mercury were studied; the test amalgam formed one pole of a concentration cell whose emf was used as a continuous measure of the concentration. The metastable region in which spontaneous nucleation could not occur extended to 2°C below the saturation temperature. Nucleation at temperatures below the metastable region normally produced a crop of fine crystals mainly suspended in the liquid phase, which sometimes subsequently aggregated into a solid cap at the surface or walls. The rate of nucleation varied approximately as exp $(-\text{const}/\Delta T^2)$. Stirring increased the nucleation rate by only a factor of about 5. The rates observed were immensely greater than those reported by Hollomon and Turnbull for pure metals subdivided into small drops; this would suggest heterogeneous nucleation on foreign particles. If a first crop of crystals were allowed to form and then to be removed from the system, the subsequent rate of nucleation was not significantly reduced by this treatment; this would suggest that the rate cannot depend on the presence of foreign particles. One possible explanation is that nucleation may occur only at the glass wall, and the growing crystallites are subsequently floated into the solution. Another depends on the further observation that if a small number of crystals is added to a solution cooled at such a rate as to keep it within the metastable region (where spontaneous nucleation cannot otherwise occur), an immense crop of nuclei is produced equal in number to that obtained with spontaneous nucleation at temperatures below the metastable region. In other words it would appear that nuclei breed nuclei with a high multiplication factor. The high rates of nucleation of a bulk liquid phase may be due to this breeding of nuclei and not to heterogeneous nucleation. If massive zinc is added to an amalgam that is in equilibrium with a solid phase that has been obtained by cooling a solution from higher temperatures, the massive zinc dissolves and is reprecipitated as very fine crystals; this is attributed to the metastability of the α phase at the temperatures in question. From emf data on 2-phase amalgams, heats of solution were calculated. The solid phase in these experiments could be largely freed from mercury by centrifugation and was found to consist of hexagonal plates and prisms rounded by stirring. (auth)

24597

THE CHANGES OF MICROSTRUCTURE OF URANIUM BY CYCLIC HEAT TREATMENT. R. I. Garber, S. Ya. Zalivadnyĭ, and V. M. Mikhaĭlovskiĭ (Khar'kov Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Fiz. Tverdogo Tela 2, 1052-9(1960) June. (In Russian)

Metallographic and x-ray diffraction methods were used in studies of the relative displacement and deformation of large-grain, cylindrically shaped uranium crystallites under cyclic treatment. The large grain (6 × 0.5 mm) structure was achieved by recrystallization of the polymorphous state; cyclic treatment was carried out at 100 to 600°C. A pronounced curvature in the deformation line was observed with a single heating up to 600°C, but this line almost straightened out upon cooling to room temperature. The displacement, calculated on the basis of data on crystal inter-orientation and thermal expansion anisotropy, exceeds by a factor of two the experimentally obtained residual displacement of 3×10^{-5} per cycle. It was found that a considerable portion of the plastic deformation was localized at the boundary. The "thermal ratchet" is complicated by the wedging of adjoining grains. X-ray diffraction revealed that crystallites separate into blocks and subgrains following cyclic thermal treatments. (R.V.J.)

24598

SEIGNETTE-ELECTRIC PROPERTIES OF SOLID SOLUTIONS IN THE $Ba(Ti, Zr, Sn)O_3$ TRIPLE SYSTEM. M. M. Nekrasov and Yu. M. Poplavko. Fiz. Tverdogo Tela 2, 1681-4(1960) Aug. (In Russian)

Preparations of non linear seigneto-electric ceramics with comparably low losses were studied using solid solutions of $Ba(Ti, Zr, Sn)O_3$. The optimum properties were found with the compositions $Ba(Ti_{0.85}, Zr_{0.11}, Sn_{0.04})O_3$ which possessed reverse non linearity $N_p = 0.9$ cm/kn and $(\epsilon \text{ max})/(\epsilon \text{ min}) = 20$ with tg $\delta = 0.03$ at small field intensity and tg $\delta = 0.15$ at high intensity. (R.V.J.)

24599

DIFFUSION OF BORON IN GRAPHITE. P. S. Kislyĭ and G. V. Samsonov (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian, SSR). Fiz. Tverdogo Tela 2, 1729-32(1960) Aug. (In Russian)

Diffusion of boron in graphite was studied in order to determine the main diffusion process parameters and the mechanism of diffusion. Data from chemical analyses of borated specimens are tabulated. At a diffusion temperature of 2350°C, $D = 49.8 \times 10^{-6}$ cm^2/sec. The diffusion coefficient as a function of temperature is expressed by $D = 3.02 \cdot e^{-286251/T}$. (R.V.J.)

24600

URANIUM OXIDE AS A NUCLEAR FUEL. Raymond Hauser (Ecole Centrale, Paris). Ing. nucleare 3, 36-43(1960) Jan.-Feb. (In Italian)

A lecture, originally delivered as a part of the 1959 ANDIN course in Fuels and Materials for Nuclear Installations, is presented. Several references are made to the basic theory of nuclear fuels, and a brief history of the use of uranium oxide as a fuel in various countries is given. The discussion includes the chemical methods for preparing the oxide and industrial methods for manufacturing fuel elements. The various phases of these procedures and the equipment needed to carry them out are described. The security measures to be adopted in order to prevent the escape of radioactive dust into the air, as well as criticality of materials, are reviewed. (auth)

24601

THE EFFECT OF LOWER OXIDES OF TITANIUM AND OF CALCIUM OXIDE ON THE PROPERTIES OF SLAGS WITH HIGH TITANIUM CONTENT. I. A. Karyazin and V. A. Reznichenko. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 3, 28-34(1960) May-June. (In Russian)

In the continuation of a previously reported work on the $TiO_2-Ti_2O_3-FeO$ phase diagram [this journal (1959) No. 5], the behavior of Ti-rich ilmenite concentrates was studied while using CaO as a fluxing agent. As a result of the work, the partial phase diagram of the $TiO_2-Ti_2O_3-CaO$ system containing constant additions of 4% SiO_2, 2% Al_2O_3, 3% FeO, and 2% MgO was determined within the region ranging from 19 to 89% TiO_2, 0 to 20% Ti_2O_3, and 0 to 20% CaO. It was found that slags of such a composition do not form equilibrium systems. The CaO additions lower the melting point and the viscosity of the melts. The TiO_2/Ti_2O_3 ratio appears to be the most important factor for the determination of the physical properties; such a ratio ranging up to 1.5 was sufficient for the preparation of slags containing 5% CaO and having a melting point within the 1550 to 1600°C range. (TTT)

24602

STUDY OF THE PARTIAL PHASE DIAGRAM OF THE Ti-Al-Cr-Fe-Si SYSTEM. I. I. Kornilov, V. S. Mikheev, and T. S. Chernova. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 3, 70-2(1960) May-June. (In Russian)

The multicomponent system Ti-Al-Cr-Fe-Si was represented by using a previously described spatial arrangement based on a tetrahedron in which the starting point of the x,y,z coordinates was set by the composition of a binary or ternary solid solution and plotting on the axes the concentrations of the remaining components. In the identification of the points of the above system, advantage was taken of the fact that Al has a broad solubility range in α and β Ti, whereas the other elements are but slightly soluble in α Ti. The phase transformations were determined by thermal analysis and by measuring the microhardness of the phases after quenching and annealing treatments. The phase diagram thus established is based on constant 0.5% content each in Cr, Fe, and Si and on variable Al concentrations from 0 to 7.5%. The quenching tests were performed from the β region, starting at 1200°C. The solidus line of the $\alpha \rightleftharpoons \beta$ transformation as a function of Al concentration was thus determined. (TTT)

24603

NEODYMIUM AND ITS ALLOYS WITH ALUMINUM. E. M. Savitskiĭ, E. S. Stepanov, and V. F. Terekhova. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 3, 73-8(1960) May-June. (In Russian)

The mechanical properties of pure Nd and Nd–Al alloys were investigated. The metal, the purity of which reached 99.5%, was found to oxidize rapidly when exposed to air. Impurities found included 0.15% Pr, 0.1% Sm, 0.2% Cd, 0.02% Ca, 0.01% Fe, and 0.005% Cu. The compressive strength of the specimens was 25 kg/mm^2; the strength to rupture after rolling was 13 kg/mm^2. The values of the melting point and the polymorphic transformation, determined by thermal analysis to be 1025 ± 5 and 860°C, respectively, agree quite well with data reported by Spedding and his collaborators. The phase diagram of the Nd–Al system was determined up to a Nd content of 80 wt. %. The solubility of Nd in Al was found to be below 0.2%. The eutectic mixture melts at 640°C. Two chemical compounds were found within the range studied. These were $NdAl_4$, formed by a peritectic reaction at 1250°C, and $NdAl_2$, obtained from the melt at 1450°C. In general, it was found that Nd addition strengthens Al. The tensile strength of an alloy containing 30% Nd is increased from 25 to 155 kg/cm^2. The tensile strength of the compounds was found to be 350 and 600 kg/mm^2 for $NdAl_4$ and $NdAl_2$, respectively. During the work foils of pure Nd with thickness below 0.5 mm were prepared. Work in progress includes the study of the effects of Nd and of other rare-earth metals on industrial Al alloys. (TTT)

24604

RECRYSTALLIZATION OF TECHNICAL GRADE TITANIUM BY FAST ELECTRICAL HEAT TREATMENT. V. I. Ivanov and K. A. Osipov (Inst. of Metallurgy, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 3, 79-82(1960) May-June. (In Russian)

Although during the heat-treatment of technical Ti the surface of the metal becomes covered with gases, causing a lowering of its plastic properties, melting in a vacuum or in protective atmospheres is not practiced. A reduction of the duration of the treatment is relied upon. However, such an action is limited by the highest possible heat transfer from the furnace to the metal and the establishment of the temperature equilibrium within the metal. In view of this, induction heating was used since this type of heating allows a direct and fast conversion of the electric energy into heat. The recrystallization rate of the technical Ti and the effect of the grain growth on the mechanical properties of the metal were studied. In comparing the mechanical properties of specimens heated by conventional and by fast induction heating, it was found that at rates of 100°C/sec the beginning and the end of the recrystallization process shifted toward higher temperatures while the hardness remained practically unchanged. Further increases of the rate, up to 600°C/sec, did not cause noticeable additional changes. Mechanical properties were not affected very much by the type of heating; but as a result of the reduced grain size, the plasticity was found to be higher after the inductive heat treatment. (TTT)

24605

PHASE DIAGRAM OF THE NICKEL–NICKEL SUBBORIDE SYSTEM. P. T. Kolomytsev. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 3, 83-5(1960) May-June. (In Russian)

Details of the Ni–NiB_2 phase diagram were developed on the basis of thermal analysis and the study of the microstructure of Ni alloys containing up to 8.5% B. The melting point of the eutectic composition (α + Ni_3B) was determined by microscopic study of the incipient melting at the grain boundary of the mixture containing 0.2% B. In addition to four previously known intermediate phases, a new η phase, which has a high microhardness, was found. The solid solution of B in Ni had the lowest microhardness; whereas the compounds had identical microhardness of 1145 kg/mm^2. The specific gravity of the intermediate phases decreases with increasing B content; these specific gravities are 8.17 for Ni_3B, 7.9 for Ni_2B, 7.5 for Ni_3B_2, and 6.5 g/cm^3 for NiB. (TTT)

24606

SUPERPLASTICITY OF EUTECTOID ALUMINUM–ZINC ALLOYS. A. A. Presnyakov and V. V. Chervyakova. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 3, 92-8(1960) May-June. (In Russian)

During the systematic study of the temperature dependence of the plasticity of the various alloys in the Al-Zn phase diagram, the highest plasticity was observed at 275°C with alloys containing from 71.6 to 88% Zn which were quenched from 400°C. Quenching from lower temperatures also yielded highly plastic specimens. An alloy containing 82% Zn had a significant plasticity at 300°C. This is attributed to the ultimate stabilization of the metastable structure formed by the spontaneous decomposition of the β_2 solid solution. The cast eutectoid alloy possesses a considerable degree of metastability; however, the strong grain distortion that takes place at the nonequilibrium crystallization phase of Al-Zn alloys prevents a continuous and uniform flow of atoms when the cast alloy is deformed. (TTT)

24607

SELF-DIFFUSION IN CAST CHROMIUM PREPARED BY THE IODINE PROCESS. N. A. Bogdanov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 3, 99-103(1960) May-June. (In Russian)

The mobility of the metal atoms in high-purity metallic Cr was determined by a radioactive tracer technique. Iodide Cr that had a purity of 99.87% was compacted under a pressure of 17 tons/cm^2, remelted under a He atmosphere, annealed, and vacuum coated with a thin layer of Cr-51. The specimens were then subjected to a diffusion annealing process at temperatures ranging from 1100 to 1350°C. The usual absorption method for the study of the diffusion rate could not be used because the brittleness of Cr made it difficult to prepare the thin foils needed for the measurements of the absorption coefficients; instead, thin layers of the metals were removed by electropolishing. Knowledge of the specific activity measured by means of the removed material at a given depth allowed a calculation of the diffusion coefficients. On the basis of the activation energy of the self-diffusion process (62400 cal/g atom), the temperature dependence of the coefficient of self-diffusion was calculated by the equation $D = 1.65 \times 10^{-3} \times e^{-62400/RT}$. (TTT)

24608

SURFACE TENSION OF LIQUID BERYLLIUM. V. N. Eremenko, V. I. Nizhenko, and Shou-wei T'ai. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Met. i Toplivo No. 3, 116(1960) May-June. (In Russian)

In order to change the large grain size and the acicular structure of Be by the addition of surface-active materials, the surface tension of the liquid metal was determined by means of the sessile drop method. The test was performed at 1500°C in a vacuum furnace at 5×10^{-5} mm Hg. Sublimed 99.98% pure metal was used. At that temperature the surface tension was found to be 1100 ± 35 ergs/cm^2. The density of the liquid metal was calculated at 1.42 ± 0.04 g/cm^3. The oxygen content after the test could not be measured with accuracy. If oxygen is a surface-active material, the above value should be reduced although the error should not exceed 100 to 150 ergs/cm^2. (TTT)

24609

PREPARATION AND PROPERTIES OF HIGH PURITY YTTRIUM METAL. H. J. Nolting, C. R. Simmons, and J. J. Klingenberg (General Electric Co., Cincinnati and Xavier Univ., Cincinnati). J. Inorg. & Nuclear Chem. 14, 208-16 (1960) Aug. (In English)

Yttrium metal of 99.8% purity was prepared by lithium reduction of anhydrous yttrium chloride prepared from commercial yttrium oxide. Physical properties of the metal so prepared are given and analytical procedures for its evaluation are discussed. (auth)

24610

INTERRELATION BETWEEN HARDNESS AND MODULUS OF ELASTICITY OF PURE METALS AT HIGH TEMPERATURES. M. G. Losivski and S. G. Fedotow. Neue Hütte 3, 489-94(1958). (Translated from Referat. Zhur. Fiz. No. 12, 1959, abstract No. 27480).

An investigation was made of the dependence between hardness and elasticity in pure Pt, Pd, Rh, Ir, W, Mo, Ti, Zr, Fe, Ni, Co, Cu, and Ag at different temperatures to 1100°C. The values of elasticity were determined by the method of transverse natural vibrations of the specimen on a resonant type machine. An analogy is found in the course of the temperature-dependence curves for hardness and elasticity. All the changes in the hardness, connected with the phase for magnetic transformations, correspond to analogous changes in elasticity. For all the above-mentioned metals, curves are also given for the dependence of elasticity on hardness at 20, 500, and 800°C. At 800°C this dependence is linear for all metals; at 500°C titanium and zirconium deviate from linearity; and at 20°C, W, Mo, Ti, Zr, and Co deviate from linearity. This confirms that the resistance to deformation at high temperatures is determined by interatomic bond forces.

24611

OPTICAL MODE SCATTERING CONTRIBUTION TO ELECTRICAL RESISTIVITY IN ZIRCONIUM HYDRIDE. Paul W. Bickel and Ted G. Berlincourt (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Phys. Rev. 119, 1603-4(1960) Sept. 1.

Electrical resistivity measurements on fcc $ZrH_{1.54}$ and fct $ZrH_{1.96}$ between 1.2 and 400°K revealed a sizeable optical mode scattering contribution. Excellent fits to the data are obtained using a simple additive combination of Grüneisen and Howarth-Sondheimer functions for the respective acoustical and optical mode scattering contributions. The corresponding acoustical and optical mode characteristic temperatures are in good accord with values derived from earlier inelastic neutron scattering experiments. (auth)

24612

CORRELATIONS BETWEEN SUPERCONDUCTIVITY AND NUCLEAR MAGNETIC RESONANCE PROPERTIES. W. E. Blumberg, J. Eisinger, V. Jaccarino, and B. T. Matthias (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters 5, 149-52(1960) Aug. 15.

The Knight shifts, line widths, and quadrupole interactions in a series of vanadium intermetallic compounds were measured using the nuclear magnetic resonance (NMR) technique. All the compounds had the β-wolfram structure with a composition V_3X, where X was As, Au, Co, Ga, Ge, Ir, Pt, Sb, and Si. Certain striking correlations were revealed between the NMR properties and the superconducting transition temperatures of these compounds and are represented graphically. The measurements were made at 4 to 400°K using 400-mesh particles. (B.O.G.)

24613

METALLOGRAPHY OF URANIUM. R. F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Soc. Metals 52, 748-62(1960).

The current state of the art of uranium metallography is summarized. As an introduction, the various allotropic transformations occurring in uranium and the crystallography of these phases are discussed briefly. Some mention is also made of common heat-treating temperatures and recrystallization temperatures. As the first step in a discussion of the metallography of the metal, the conventional preparatory techniques, including mechanical and electrolytic polishing methods, etching techniques, and the use of polarized light for the delineation of structure, are discussed in some detail; appropriate illustrations are presented. In addition, nonconventional techniques, such as vacuum-cathodic etching, anodic oxidation, hot-stage microscopy, and strain etching, are described and evaluated. The five so-called basic metallographic structures of uranium are: (1) alpha annealed, (2) alpha, transformed-beta quenched, (3) alpha, transformed-beta slow cooled, (4) alpha, transformed-gamma quenched, and (5) alpha, transformed-gamma slow cooled. These are illustrated and described. Limited mention is made of certain peculiarities in the structures, such as the ghost or subgrains that are quite common in the alpha-transformed-beta structures. In conjunction with the discussion of structure, the techniques now in use for determining the grain size of uranium in different conditions of heat treatment are briefly described. A modification of the Jeffries' method is commonly used for all structures but the alpha-transformed-beta structures. The determination of grain size in the alpha-transformed-beta structures is difficult, but a specially developed macro technique is slowly being accepted for this purpose. The paper is concluded with a discussion of nonmetallic inclusions in uranium. Typical photomicrographs illustrating these inclusions are shown, and some of the current thinking concerning the UO and UN group is discussed briefly. (auth)

24614

INFLUENCE OF VANADIUM, MOLYBDENUM, AND CHROMIUM ON THE PROPERTIES OF $\alpha + \beta$ – TITANIUM ALLOYS WITH ALUMINUM AT ELEVATED TEMPERATURES. Karl Bungardt, Klaus Rüdinger, and Hans Hermann Weigand (Deutsche Edelstahlwerke A.G., Krefeld, Ger.). Z. Metallk. 51, 466-76(1960) Aug. (In German)

Investigations of heat resistant $\alpha + \beta$-titanium alloys of the type Ti6Al4M, Ti6Al6M, Ti7Al3M, and Ti6Al3,5Mo 0,5 (B,C,Si) showed that the strength-improving effect of the β-stabilizing alloying elements increased in the order vanadium, molybdenum, chromium. However, the ductility was reduced in the same order. The strength increase by the chromium addition was effective in the annealed samples, the samples quenched from the $\alpha + \beta$ field, and the samples quenched and afterwards aged. (auth)

24615

DIFFUSION OF Xe-133, Rn-222, AND I-131 IN THORIUM OXIDE. Hj. Matzke and R. Lindner (Technische Hochschule, Göteborg). Z. Naturforsch. 15a, 647-8(1960) July. (In German)

In a study of the mobility of fission products in ceramic fuel and breeder elements, the diffusion of Xe^{133}, Rn^{222}, and I^{131} in thorium oxide was measured. The results obtained for xenon at 910°C and for radon at 1010°C are graphed as a function of time. The diffusion constants at different temperatures are then diagrammed logarithmically against the reciprocal temperature. A significant difference in the activation energy for ThO_2 and UO_2 was found. (J.S.R.)

24616

PREPARATION OF THORIUM CARBIDES. G. V. Samsonov, T. Ya. Kosolapova, and V. N. Paderno. Zhur. Priklad. Khim. 33, 1661-4(1960) July. (In Russian)

Being refractory and resistant when exposed to high current densities, thorium carbides are of great interest for the electronics industry as cathode materials. The monocarbides and dicarbides found in the Th–C phase diagram were prepared by heating the stoichiometric mixtures of ThO_2 and C in a vacuum furnace at temperatures ranging from 1000 to 1900°C. The optimum temperature for the formation of both carbides was 1800°C under a vacuum of 2 to 3×10^{-2} mm Hg. The carbides were found to be easily soluble in water, acids, and alkalis. (TTT)

24617

DETERMINATION OF THE SOFTENING POINT OF MIXTURES IN THE BERYLLIUM–BORON SYSTEM AT THE BERYLLIUM-RICH REGION. L. Ya. Markovskiĭ and G. S. Markevich (State Inst. of Applied Chemistry, USSR). Zhur. Priklad. Khim. 33, 1667-9(1960) July. (In Russian)

The phase diagram of the Be–B system was investigated up to 50 at.% boron by sending an electric current through the compacts and determining their softening points from the observed bending moments, while the temperature was measured by means of a microoptical pyrometer with a precision of ±5°C. Composition of the specimens was ascertained by x-ray diffraction and chemically by periodate oxidation. The semiconducting properties of BeB_2 and the high electrical resistance of the mixtures beyond BeB_6 precluded the use of the above-mentioned method, but extrapolation of data appears to be in agreement with previously published results. It is concluded from the data that the melting point of the mixtures lie about 70 to 80°C above the measured softening points. Comparing the results with metallographic observations, it is concluded that the eutectic composition, at about 11 at.% boron, represents the minimum on the temperature vs. boron concentration graph, whereas the maxima at 16.5 and 33.0 at.% boron represent chemical compounds. According to x-ray diffraction studies, the eutectic consists of metallic beryllium and the δ-phase. (TTT)

24618

MAGNESIUM AND ITS ALLOYS. C. Sheldon Roberts. Wiley Series on the Science and Technology of Materials. New York, John Wiley & Sons, Inc., 1960. 239p.

It is intended that this book should serve as a reference for the modern metallurgist, physicist, chemist, or engineer. Its broad scope and concise presentation cover the generalities of the science and technology of magnesium. It is not intended as a shop manual or as a handbook for the structural designer. All but the most important properties of the alloys of magnesium were omitted. More complete data on alloy properties are available in the commercial literature. Phase diagrams of the more common binary and ternary alloys are included. (B.O.G.)

24619

CERMETS. J. R. Tinklepaugh and W. B. Crandall, eds. New York, Reinhold Publishing Corporation and London, Chapman & Hall, Ltd., 1960. 244p.

Information is included on carbide- and oxide-base cermets and their applications at high temperatures. The physicochemical aspects of cermets are described to acquaint the reader with the relations between ceramics and metals which govern the selection of materials and the properties obtained. The descriptions of the preparation of materials and fabrication processes are somewhat limited by the proprietary nature of the information. The papers are limited to sources in the United States. The principle effort is toward the development of titanium carbide-base cermets for use in jet engines, and, for this reason, more information is available concerning the fabrication and properties of these cermets than any other type. The fabrication and properties of aluminum oxide-base cermets are also discussed. Present and future applications of cermets are discussed. (B.O.G.)

24620

APPLICATION OF THE (n,α) REACTION. A. H. Bushey and Barbara A. Thompson (General Electric Co., Schenectady, N. Y.). p.44-5 of "Symposium on Radioisotopes in Metals Analysis and Testing. Presented at the Sixty-second Annual Meeting, Atlantic City, N. J., 1959. ASTM Special Technical Publication No. 261." Philadelphia, American Society for Testing Materials, 1960.

The (n,α) reaction is applicable particularly to boron-10. In applying this reaction in the analysis of boron, it is necessary to detect the emitted α particles while the specimen is being irradiated. The reaction is not particularly applicable for determining boron content, but it can be applied very effectively for detecting boron segregation on solid surfaces. The analysis is performed by coating the test surface with a photographic emulsion which has low absorption for neutrons and gamma rays and a strong absorption for the heavier, charged α particles. After exposure the emulsion is developed in situ on the surface of the specimen. A photograph of the developed specimen thus shows the structure of the metal under the thin film with the superimposed darkened areas defining the regions of high boron content. Error sources arise principally in connection with defects in the film resulting from faulty application and handling. A detectable response is not obtained with less than ~1% boron segregation. (B.O.G.)

24621

PLUTONIUM–CERIUM ALLOY. (to U. S. Atomic Energy Commission). British Patent 846,433. Aug. 31, 1960.

Pu^{239} must be diluted by alloying before it can function well as a reactor fuel; plutonium-cerium alloys are excellent for this purpose, cerium having good neutronic, fabrication, and radiation resistance properties. Plutonium-cerium alloys can be prepared by melting and cooling and can be cast into desired shapes. From the given phase diagram, it is seen that for alloys of 0 to 15 at.% cerium, the phase is δ plutonium, and for alloys of 15 to 90 at.% cerium, the phase is a mixture of δ plutonium and α cerium; either phase may be used in reactors. The ratio of plutonium weight in a critical-mass alloy to that in critical-mass unalloyed plutonium was studied as a function of at.% cerium, and it is seen that cerium keeps the ratio closer to unity than other metals, the ratio being 1.3 at 10 at.% cerium. It is noted that plutonium-cerium alloys containing 15 to 80 at.% cerium must not be used in reactors above 550°C since at that temperature the δ phase transforms to the ε phase with a sudden change in volume. (D.L.C.)

Radiation Effects

24622 ANL-6091
Argonne National Lab., Ill.
EXAMINATION OF IRRADIATED EBWR CORE-I FUEL ELEMENTS. C. F. Reinke and R. Carlander. July 1960. 32p. Contract W-31-109-eng-38. OTS.

Two fuel elements were removed from the Experimental Boiling Water Reactor and examined in a hot cell. The elements had maximum burn-ups of 0.11 and 0.39 at.%. Both were disassembled and sampled for the evaluation of the effects of in-pile operation and radiation damage to the fuel. The fuel elements were in good condition with no ruptured cladding, core-clad nonbonds, or excessive fuel-plate swelling or warpage. Thin samples cut from the fuel plates in element ET-51 warped and cracked, suggesting a relieving of locked-in stresses and indicating that after 0.39 at.% burn-up the fuel cores were hard, brittle, and highly stressed. The rate of fuel-plate volume increase owing to the burn-up of uranium was 6 to 7% ΔV per at.% burn-up. Hydrogen was picked up by the fuel plates under reactor operating conditions with the probable formation of isolated areas of small amounts of zirconium hydride. Annealing studies on sections of fuel plate at 500 and 550°C indicated bulk volume increases of 1 to 2% and 5 to 10%, respectively, after 500 hr. A 600°C anneal resulted in a bulk volume increase of 17% after 45 hr. (auth)

24623 GEAP-3292
General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.
IRRADIATION AND POST-IRRADIATION EXAMINATION OF APPR TYPE FUEL ELEMENTS. D. L. Zimmerman. Nov. 1959. 50p. For Alco Products Co. Contract DA-44-009-ENG-3506, Subcontract AP-1021.

Two fuel assemblies consisting of four modified Army Package Power Reactor fuel elements were irradiated to peak burn-up values of approximately 20% and at a maximum surface heat flux of 339,000 Btu/hr/sq ft. Post-irradiation examination revealed no significant dimensional changes with the exception of fuel plate rippling. No corrosion effects were observed. Metallographic examination revealed fission gas bubbles in the UO_2 fuel particles. (auth)

24624 HW-34868 C 11
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NUCLEAR METALLURGY LECTURES. CHAPTER 11. G. A. Last. May 25, 1955. Decl. June 10, 1960. 4p. Contract [W-31-109-Eng-52]. OTS.

The mechanisms responsible for dimensional changes in U as a result of thermal cycling and of irradiation are discussed. (C.H.)

24625 NP-8974
International Business Machines Corp. Federal Systems Div., Owego, N. Y.
PULSED RADIATION EFFECTS ON ELECTRONIC COMPONENTS. First Triannual Report [for] February 1960 to June 1960. July 20, 1960. 61p. Contract AF33(600)-40462.

The status of investigations concerned with the experimental measurement and theoretical prediction of the electrical behavior of selected components under high-intensity bursts of nuclear radiation is discussed. Components tested include capacitors, resistors, transistors, solar cells, photomultiplier tubes, and gas diodes. Test instrumentation and procedures are described and test results are compared with theoretical predictions. Primary emphasis is placed on experiments with capacitors and resistors. Methods of discriminating between the effects of neutron and gamma radiation are also discussed. Major conclusions are listed. (J.R.D.)

24626 NP-9020
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
MONTHLY ACCESSION LIST NO. 37 [ON RADIATION EFFECTS DATA]. July 15, 1960. 24p. Project No. 2133. Contract AF33(616)-7375.

Abstracts of 71 papers pertaining to radiation effects on electrical and electronic systems, polymeric materials, fuels, lubricants, hydraulic fluids, organic and inorganic compounds, metals, and alloys are presented. Abstracts on dosimetry, irradiation facilities, and space radiation are also included. (C.T.G.)

24627 NP-9197
Stanford Research Inst., Menlo Park, Calif.
EFFECT OF RADIATION ON THE MECHANICAL PROPERTIES OF PLASTICS. Quarterly Progress Report VIII (Report No. 8) [for] August 15, 1959—November 15, 1959. David L. Chamberlain, Jr., Vincent Salmon, and Robert L. Walrath. Dec. 1, 1959. 17p. Project No. SU-2296. Contract DA-04-200-ORD-698.

Work is reported on the development of a suitable sonic annealing device for dissipation of free radicals induced in some polymers by high-energy radiation, in order to obtain greater reproducibility of dynamic elastic-modulus measurements. (W.L.H.)

24628 NP-9198
Stanford Research Inst., Menlo Park, Calif.
EFFECT OF RADIATION ON THE MECHANICAL PROPERTIES OF PLASTICS. Final Report. David L. Chamberlain, Jr., Robert L. Walrath, and Vincent Salmon. Feb. 19, 1960. 51p. SRI Project No. SU-2296. Contract DA-04-200-ORD-698.

The objective of this research was to study the relation between radiation-induced chemical changes in plastics and changes in their physical properties by a correlation of dynamic modulus with other applicable properties. Initial investigations were devoted to constructing a vibrating reed apparatus, building a mold for preparing reed specimens, and developing procedures for molding reed with acceptable dimensions. The vibrating reed apparatus proved to be quite sensitive to a number of variables. The method that gave the least strains and most uniformity of plastic sheets was the double-pressing method. The molecular weights of the irradiated polymethylmethacrylate reeds were calculated from intrinsic viscosity data of chloroform solutions. The molecular weight decreased as the radiation dose increased. Solvent swelling and static elastic modulus measurements on polyethylene were made at elevated temperatures. (W.L.H.)

24629 TID-6340

General Atomic Div., General Dynamics Corp., San Diego, Calif.

GENERAL ATOMIC CONTROL ROD IRRADIATION PROPOSAL. W. W. Godsin. Nov. 20, 1959. 6p. Project No. 32. Contract AT(04-3)-314. (GAMD-1103). OTS.

A capsule irradiation experiment is described for investigating the stability of BC dispersed in graphite under the influence of neutron bombardment for control rod material. (C.J.G.)

24630

RESISTIVITY OF PURE IRON IRRADIATED WITH NEUTRONS. Colette Cassayre, Daniel Dautreppe, and Jean Paulevé (Centre d'Études Nucléaires, Grenoble, France). Compt. rend. 251, 370-2(1960) July 18. (In French)

Some samples of pure iron irradiated at 35 to 78°K were studied by measurement of the electrical resistance at 20°K. The isothermal anneals made give activation energies of 0.22 ev at 100°K and 1.4 ev at 200°C for the principal stages of anneal. (tr-auth)

24631

INFLUENCE OF ULTRA VIOLET AND X-RAY RADIATION ON THE INTERNAL FRICTION OF SILVER CHLORIDE. M. P. Shaskol'skaya and Ya. Kh. Vekilov (Kiev State Univ.). Fiz. Tverdogo Tela 2, 1107-10(1960) June. (In Russian)

The influence of x rays and ultraviolet radiation on the amplitude independent internal friction in AgCl at low frequencies (1 Hz) was studied using 1.5-mm-diameter, 8-cm-long specimens of deformed (~99% compressed) and annealed AgCl. The temperature dependence of internal friction, Q^{-1}, following exposure to ultraviolet radiation decreases exponentially with time. Q^{-1} is reduced faster in annealed specimens than in deformed. The tensile strength of irradiated specimens is 25% higher than in deformed specimens. Both x rays and ultraviolet radiation produce similar effects. (R.V.J.)

24632

INFLUENCE OF BOMBARDMENT BY FAST ELECTRONS ON SILICON ELECTROCONDUCTIVITY, AND DEPENDENCE OF THE VELOCITY OF DEFECTS FORMATION ON THE ORIENTATION OF THE CRYSTAL RELATIVELY TO THE ELECTRONIC BEAM. V. S. Vavilov, V. M. Patskevich, B. Ya. Yurkov, and P. Ya. Glasunov (Lebedev Inst. of Physics, Moscow). Fiz. Tverdogo Tela 2, 1431-3(1960) July. (In Russian)

Rectangular specimens, variably oriented with respect to the direction to the beam, were bombarded by fast electrons with an initial energy of 500 kev for the purpose of determining the defect forming processes in silicon p-type monocrystal. Prior to bombardment the specimens were uniform in their specific resistance, 160 ohm. The bombardment was carried out at room temperature; during bombardment the specimens were cooled by water. The specific resistance ρ was plotted as a function of beam penetration along the axes 111, 110, and 100. The conductance was quite stable at room temperature. The maximum depth at which it was possible to observe a variation of ρ was about 0.6 mm, and it did not depend on the orientation of the specimen. Considerably stronger variations in conductivity were found near the surface of the <111> axis; the other two orientations were about equal. The experiments indicate that a greater number of defects occurred in atom displacements along the <100>, <010>, and <101> axes. (R.V.J.)

24633

ON THE RADIATION DEFECTS IN CRYSTALS. L. S. Smirnov (Lebedev Inst. of Physics, Moscow). Fiz. Tverdogo Tela 2, 1669-70(1960) July. (In Russian)

It is postulated that radioinduced defects and changes in crystalline structures appear as the result of energy transmission to the atoms by heating the lattice and slightly shifting the lattice parameters. Only a small number of adjacent atoms participate in the process. Following the collision, a small region of atoms with broken crystalline bonds appears near the initially excited atom. The excited region is under a pressure of $\sim 10^4$ kg/cm^2 in substances that expand with melting. Under pressure the atoms may shift in the excited region. In some materials the order of atoms changes and results in reduced volume. Germanium and silicon are analyzed as substances that reduce in volume melting. (R.V.J.)

24634

ON THE INFLUENCE OF ADHESION LEVELS ON RELAXATION OF NON-EQUILIBRIUM CONDUCTIVITY IN GERMANIUM IRRADIATED BY γ-RAYS. S. M. Ryvkin and I. D. Yaroshetskiĭ (Leningrad Inst. of Physics and Tech.). Fiz. Tverdogo Tela 2, 1966-77(1960) Aug. (In Russian)

The influence of γ-radiation induced defects on the temperature dependence of photoconductivity relaxation time in germanium is analyzed and the mechanism of recombination processes related to the defects is found. Descriptions are given of the experimental installation and the obtained data are plotted. The parameters of recombination centers and the knock-on levels formed by γ rays were determined on the basis of experimental and theoretical data. The coefficients of vacancy and electron captures by centers acting as knock-on levels and their positions in forbidden zones were determined, and it is shown that at low temperatures the knock-on levels convert to recombination and determine the recombination in n-Ge. (R.V.J.)

24635

THE PROTECTIVE PROPERTIES OF SYNTHETIC FIBERS AGAINST RADIATION. Kuang-ti Pao. Hua Hsüeh Shih Chieh 13, 498-500(1958). (Translated from Referat. Zhur. Khim. No. 21, 1959, abstract No. 77105).

Fabrics made from polyamide fibers treated with lead, barium, or cadmium salts or with graphite or mica powder, and fabrics made from cellulose fibers which were coated with a film of polyvinyl or polystyrene resin, exhibit protective properties against radiation.

24636

THE EFFECTS OF NEUTRON IRRADIATION ON THE PROPERTIES OF IRON AND STEELS. D. R. Harries (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 5, 133-49(1960) July.

The principle mechanisms of radiation damage in nonfissile metals are summarized, and the terms used in irradiation experiments defined. Neutron irradiation effects on the mechanical properties of single and polycrystalline pure iron are described, and the effects on the properties of ferritic and austenitic steels are given. The extent to which the exchanges in mechanical properties are affected by the irradiation and metallurgical variables is reviewed. Results on the annealing of radiation damage are considered, and the available data on the mechanism of the radiation embrittlement surveyed. Finally, the present position and the future work required to further the understanding of radiation damage in steels are summarized. (auth)

24637

GAMMA RADIATION EFFECTS ON SOME ION-EXCHANGERS. Miroslav Prešek, Miloslav Křivánek, and

Jaroslav Bednář (Military Academy, Brno). Jaderná energie 6, 267-71(1960). (In Czech.)

Co^{60} γ radiation effects on solubility, swelling, and exchange capacity of F-Extra, FN, and S cation exchangers were studied. Some conclusions are made on the mechanism of radiation changes in a mixture of a cation exchanger and water. The investigated ion exchangers are estimated from the standpoint of their radiation stability. (auth)

24638

MICRO-CRACKS AND THEIR RELATION TO FLOW AND FRACTURE IN SINGLE CRYSTALS OF MAGNESIUM OXIDE. F. J. P. Clarke and R. A. J. Sambell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 5, 697-707(1960) July.

Evidence on mechanisms of fracture in single crystals of MgO subjected to tensile loading is given. As-cleaved crystals contain micro-cracks typically 10^{-4} in. long, and slip originating from near these cracks occurs during deformation. At a later stage the cracks grow gradually until they increase to a critical size when catastrophic propagation occurs. If the cracks are removed by polishing, ductility is enhanced five to ten times. Some crystals were reactor irradiated to doses in the range 10^{14} to 10^{19} nvt (epithermal), and the effects of this treatment on flow and fracture are described and discussed. (auth)

24639

MAGNETIC RESONANCE AND RAPID PASSAGE IN IRRADIATED LiF. James S. Hyde (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 119, 1483-92(1960) Sept. 1.

The experimental result of Portis that at room temperature the paramagnetic dispersion signal $(d\chi_m/dH)$ of radiation-induced paramagnetic centers in LiF has the shape of an undifferentiated Gaussian curve and lags the modulation field by 90° was confirmed. His theory, explaining this result as a manifestation of rapid-passage behavior, was tested over a range of experimental parameters and appears valid. In terms of this theory the spin-lattice relaxation time was found to be $T_1 = 1.5 \times 10^{-4}$ sec at room temperature. The prediction was made by Portis that, if $\omega_m T_1 \gg 1$, where ω_m is the modulation frequency, the rapid-passage signal should lag the modulation field by 180°. A lag of 130° was found at 4°K in LiF, by the use of a modulation frequency of 23 cps, and the phase appears to approach a constant value. The same phase shift (130°) can be found at room temperature by using 400-cps modulation and can be interpreted as indicating that $T_1 = 2.6 \times 10^{-3}$ sec at 4°K. It seems more likely, however, that at 4°K the assumption made by Portis that $T_2 \gg T_1$ fails and that spin-spin effects make the situation more complex. An argument is presented that the magnetic resonance arises from the F center. From its shape a value ($h_\gamma = 32 \pm 1$ gauss) was obtained for the hyperfine splitting. This result is compared with those of other workers who have reported resolved structure in LiF, and the conclusion is reached that the resolved structure resonances probably do not arise from the F center. (auth)

24640

RELATION BETWEEN X-RAY COLORATION AND OPTICAL BLEACHING OF KCl CRYSTALS. W. E. Bron (International Business Machines Research Center, Yorktown Heights, N. Y.). Phys. Rev. 119, 1853-63(1960) Sept. 15.

Changes in the absorption of KCl crystals in the spectral region of 200 mμ to 1000 mμ were observed during room temperature x-ray irradiation and subsequent bleaching with F light. It was observed that both coloration and bleaching of the F band occurred in two stages. Secondary centers such as M, R, and V_3 centers grew primarily during the second stage of coloration, and the rate of growth of these centers during the second stage was enhanced by plastic deformation in a manner similar to that of the F band. It was found that the absorption change at the F band during the first stage of bleaching approximately equaled that during the first stage of coloration. Furthermore, the initial rate of bleaching of the F band was proportional to the initial F band absorption in samples irradiated only into the first stage of coloration but was essentially independent of the initial F band absorption in samples irradiated into the second stage of coloration. It was concluded from this and other evidence that the center responsible for the first stages of coloration and bleaching differed from the center responsible for the second stages of coloration and bleaching. A major point of difference was that the first stage centers were considered to be located in the bulk of the crystal, whereas the second stage centers were located in the vicinity of dislocations. It was also observed that M centers which were formed from F centers during the first stage of bleaching could be bleached with F light. To explain the observations concerning this M band bleaching, it was proposed that M as well as F centers were bleached when they were joined by mobile defects, possibly vacancy pairs. Some of the second stage centers located in the vicinity of dislocations were thought to compete with the centers located in the bulk of the crystal for the mobile defects. (auth)

24641

DEPENDENCE OF THE OPTICAL BLEACHING RATE OF X-IRRADIATED KCl CRYSTALS ON LIGHT INTENSITY. W. E. Bron and W. R. Heller (International Business Machines Research Center, Yorktown Heights, N. Y.). Phys. Rev. 119, 1864-8(1960) Sept. 15.

Measurements were made on the changes in the bleaching rate of the F band as the result of varying the intensity of F light. Bleaching was done on KCl crystals that were irradiated at room temperature with hard x rays into either the first or second stage of coloration. In the first stage irradiated crystals, the total bleaching of the F centers during the first ten seconds of illumination varied approximately linearly with light intensity at low intensities but became saturated at intensities greater than 5×10^{14} photons/sec cm^2. The bleaching process was thought to occur primarily through the capture of photoelectrons at pre-existing electron traps. Based on this model it was possible to set up the kinetic equations for the bleaching process. Using reasonable values for photoelectron capture coefficients forced the conclusion that the number of photoelectrons was always very small throughout the bleaching process. The resulting simplification in the analysis of the kinetic equations led to a prediction of the experimentally observed variation of the initial bleaching rate with light intensity. The analysis showed that the ratio of the capture coefficient for photoelectrons of the electron trapping centers to that of negative-ion vacancies was about unity, which strongly suggested that the trapping centers were either traps with net positive charge or were neutral traps located close to the original F centers. The rate of bleaching during the second stage of bleaching saturated at the lowest intensity used, which was about 1×10^{14} photons/sec cm^2. This result is discussed in terms of the analysis given for the first stage of bleaching. (auth)

24642

PROPERTY VARIATIONS OF SiO_2—CRISTOBALITE BY IR-

RADIATION WITH FAST NEUTRONS AND BY INTRODUCTION OF FOREIGN ATOMS. O. Krisement and G. Trömel (Max-Planck-Institut für Eisenforschung, Düsseldorf). Z. Naturforsch. 15a, 634-40(1960) July. (In German)

By irradiation with 1.3×10^{19} fast neutrons per cm^2 at about 50°C the $\alpha \rightleftharpoons \beta$ inversion of pure SiO_2 cristobalite is markedly displaced to lower temperatures.. The lattice parameters increase. Repeated tempering up to 500°C does not change the irradiated state. Tempering at 1600°C gives full recovery and restores the inversion temperatures before irradiation. An addition of TiO_2 to pure SiO_2 cristobalite produces a cristobalite with similar inversion temperatures as irradiated cristobalite. The lattice parameters are also increased. (auth)

24643

PROCESS FOR MODIFYING SYNTHETIC CONDENSATION POLYMERS. (to E. I. Du Pont de Nemours and Co.). British Patent 838,412. June 22, 1960.

Properties of condensation polymers can be modified without any of the disadvantages of inert fillers, copolymerization, or coatings by contacting with an organic modifier and subjecting to irradiation. Such modifiers may be alcohols, ethers, mercaptans, thioethers, disulfides, amines, amides, halides, unsaturated compounds, dyes, or polyethers. The various aspects of the modification process are treated fully and illustrated by 35 examples. (D.L.C.)

24644

MODIFIED SYNTHETIC CONDENSATION POLYMERS AND THEIR PRODUCTION. (to E. I. Du Pont de Nemours & Co.). British Patent 838,413. June 22, 1960.

A method is proposed for modifying the properties of condensation polymers by inducing graft copolymerization by irradiation while in intimate contact with an unsaturated acid of low molecular weight or one of its derivatives. Suitable unsaturated acids are crotonic, furoic, acrylic, maleic, dichloromaleic, fumaric, and itaconic and substituted derivatives thereof. The grafted structures usually contain free carboxyl or carboxylate metal salt groups; carboxyl groups may be converted into carboxylate salt groups by soaking the graft polymer in a solution of a basic metal salt. Examples are given in which nylon is saturated with maleic anhydride solution or a solution of maleic anhydride and methoxydecaethyleneoxy methacrylate monomer, wrung out, and irradiated. (D.L.C.)

24645

IMPROVEMENTS IN OR RELATING TO A PROCESS FOR THE TREATMENT OF POLYETHYLENE. (to Sequoia Process Corp.). British Patent 842,873. July 27, 1960.

The properties of polyethylene can be improved by irradiating at high-energy doses of 10^6 to 10^8 roentgens equivalent physical in the presence of a rubber accelerator or vulcanizing agent containing sulfur, selenum, tellurium, or a sulfonyl hydrazide, called bridging agents. Properties can be further improved by annealing in the presence of vulcanization accelerators, e.g., mercaptothiozoles, thiuram sulfides, guanidines, and selenium diethyl dithiocarbamate. Conventional antioxidants may be added. After irradiation in the above way, polyethylene shows increased resistance to flow and distortion at high temperatures, especially after annealing at 130 to 160°C for several hours. One important use of the method is to insulate electric components with foamed polyethylene which can be manufactured with blowing agents serving also as bridging agents, e.g., disulfonyl hydrazides which decompose to furnish N_2 for blowing. The proportion of the bridging agent is usually around 1%, although 40% could be used for producing hard rubber-like materials. Three applications of the above method are given together with data on the mechanical properties of polyethylene treated in the above manner and of polyethylene treated in the same way but with no additives. (D.L.C.)

24646

IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF COATED ARTICLES. (to E. I. Du Pont de Nemours & Co.). British Patent 845,897. Aug. 24, 1960.

Shaped organic polymers may be coated by subjecting to electromagnetic ionizing radiation and then contacting with an unsaturated organic compound capable of homopolymerization, the irradiation step taking place below 20°C, preferably below 0°C. The shaped organic polymers may be hydrocarbon, halogenated hydrocarbon, ester, hydroxyl, ether, or condensation polymers as well as copolymers or natural polymers like cotton, wool, and silk. Homopolymerizable compounds may be styrene, acrylic acid, vinyl chlorides, ethylene, or substituted vinyl compounds. The advantages of this method of polymer modification are that the irradiation step can be carried out independently of the contacting step and that the coating materials are not exposed to radiation. An application of this method is given. (D.L.C.)

24647

IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF COATED ARTICLES. Edward Terry Cline and David Tanner (to E. I. Du Pont de Nemours & Co.). British Patent 845,898. Aug. 24, 1960.

Shaped organic polymers may be coated by subjecting to ionizing radiation and then contacting with an unsaturated organic compound capable of homopolymerization, the irradiation step taking place below 20°C, preferably below 0°C. The procedure differs from that of Patent Serial No. 845,897 only in that particle radiation is used in place of electromagnetic radiation. Four applications of this method are given. (D.L.C.)

PHYSICS

General and Miscellaneous

24648 AD-232865

Geophysics Corp. of America, Boston.

A STUDY OF AN ADVANCED ELECTROMAGNETIC COMMUNICATIONS SYSTEM. Final Technical Report Covering the Period July 1 through December 31, 1959. 239p. DA Project No. 3-99-12-104. Contract DA-36-039 SC-78971.

The use of an electron cloud in a communications system was investigated. The effects of thermal ionization efficiency, upper atmosphere wind velocities, wind shear, ambipolar diffusion, neutral diffusion, chemical yield of contaminant, and several decay processes upon the propagation capabilities of electron clouds are discussed. Methods for optimizing the artificial ionosphere propagation capability are suggested. Alkali metals—Al generation of artificial electron clouds is analyzed using a deflagration model for reaction which allows calculation of the observed chemical yield of neutral alkali atoms. The electron yield of the expanded cloud is then obtained from an elementary model of electron-ion recombination during initial expansion. Improvements in ionization yield by use of detonation or propellant releases are described and factors important to optimization are discussed. Experimental yields for detonation and propellant systems are considered. The r-f communications capability of the artificially generated ionosphere is discussed. The geometrical limitation of cloud generation altitude is discussed as a function of system communications range. The altitude requirements for the limiting case of world-wide communications are noted. The electronic system parameters (antenna gains, transmitter power, carrier frequency, etc.) that are required to perform certain communications functions are analyzed. (C.J.G.)

24649 AERE-R-3226
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE OPTICAL SPECTRA OF SOME RARE EARTH AND ACTINIDE ELEMENTS IN THE 1–2.5 MICRON REGION. PART VI. THE SPECTRUM OF URANIUM. N. Atherton and L. Bovey. June 1960. 30p. BIS.

Wave lengths, intensities, and isotope shifts were determined for U in the 1- to 2.5-μ region. (C.J.G.)

24650 AFOSR-TN-60-705
Rochester, N. Y. Univ.
IMPURITY STATES IN SOLID NEON. Albert Gold. June 1960. 68p. Contract AF49(538)-432. OTS.

A formalism for the treatment of optical absorption by an isolated substitutional impurity center is given. The tight-binding approximation is used, and the method of constructing one-electron trial functions for the system is outlined. The first-order absorption energies, oscillator strengths, and integrated absorption coefficients are computed in an approximation which includes spin-orbit interaction and the overlapping of heterocentric atomic wave functions through terms of order S^2. The first-order energies are corrected for van der Waals interactions using a variational formalism. A phenomenological method for computing the emission energies of the system is given. The specific example of an argon impurity atom in solid neon is treated numerically. The computation predicted absorption lines at 11.7 and 11.6 ev owing, respectively, to the $^1P_1$ and $^3P_1$ states of the argon impurity, with an uncertainty of 1.3 ev. The oscillator strengths for these transitions are calculated to be 0.164 and 0.017, respectively, giving rise to integrated absorption coefficients of 0.84×10^6 N_0 and 0.09×10^6 N_0 ev cm^{-1} for the two states, where N_0 is the (small) fractional concentration of impurities in the host lattice. (auth)

24651 AFOSR-TN-60-865
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
LANGEVIN'S THEORY OF THE MOBILITY OF GASEOUS IONS. Technical Report No. 4. E. W. McDaniel. Aug. 1, 1960. Contains a translation from "Une Formule Fondamentale de Théorie Cinétique," (A Fundamental Formula of Kinetic Theory), by Paul Langevin. Ann. chim. et phys. (8) 5, 245-88(1905). 48p. Contract AF18(600)-1524.

An English translation of the main body of Paul Langevin's classic paper on the mobility of gaseous ions is presented. The title of the original paper was "Une Formule Fondamentale de Théorie Cinétique," and it appeared in Annales de Chimie et de Physique, Series 8, 5, 245-288(1905). The historical introduction in the original paper was omitted in the translation. An appendix dealing with the polarization attraction of molecules by ions was added, and a number of changes were made in notation and terminology in conformity with modern convention. Misprints in several equations were corrected. (auth)

24652 AFSWC-TR-60-20
Republic Aviation Corp. Missile Systems Div., Mineola, N. Y.
STUDIES OF THE THEORY OF SPALLATION. Final Report. Walter F. Waldorf, Jr. May 12, 1960. 43p. Project No. 5776. Contract AF29(601)-1777. (MSD-217-950).

The process of spallation and its separation into the two phenomena of stress-wave propagation in solid materials and fracture under dynamic loading are described. A brief account of the present state of knowledge concerning fracture, as well as the experimental data that form the basis of the theoretical development and the fracture criterion that is to be used, is given. A comprehensive theoretical derivation of Zhurkov's law of time-dependent fracture is presented. The results of this analysis and other factors entering into fracture processes are discussed. A brief account of some experimental methods that could be used to study spallation is given. (auth)

24653 ANL-6169
Argonne National Lab., Ill.
PHYSICS DIVISION SUMMARY REPORT. June 1960. 77p. Contract W-31-109-eng-38. OTS.

Informal reports are presented on experimental nuclear physics, mass spectroscopy, and crystallography. Each individual project reports about once in 3 months. Those not reported in a particular issue are listed separately in the table of contents with a reference to the last issue in which each appeared. (For preceding period see ANL-6164.) (W.D.M.)

24654 ANL-6169(p.41-50)
Argonne National Lab., Ill.
LEAD AGES OF METEORITES. David C. Hess and Royal Marshall.

Lead in some stone meteorites was analyzed. The ages were all very close to 4.6 aeons. (auth)

24655 ANL-6196
Argonne National Lab., Ill.
LOGARITHMIC SPIRAL LIGHT PIPE FOR SCINTILLATORS. William C. Kaiser, Anthony J. MacKay, and William W. Managan. Aug. 1960. 12p. Contract W-31-109-eng-38. OTS.

A procedure is described for designing and making logarithmic spiral light pipes which are to be used in coupling scintillators to photomultipliers in cases where the scintillator must be placed in a strong magnetic field. (C.J.G.)

24656 BLG-42
Brussels. Centre d'Étude de l'Énergie Nucléaire and California. Univ., Berkeley. Lawrence Radiation Lab.
DEVELOPPEMENT A BASSE TEMPERATURE. (Development at Low Temperatures). W. H. Barkas and J. Fournaux. Jan. 7, 1960. 11p.

In order to avoid distortions at the time of the development of thick nuclear emulsions, an amidol developer at 0°C was used. The best conditions of development and the developer composition are discussed. The convenient fog-particles discrimination is obtained for a 10 hours' development in amidol with a small amount of KBr. (auth)

24657 BNL-617
Brookhaven National Lab., Upton, N. Y.
SOLUBILITY OF XENON IN LIQUID BISMUTH. A. M. Eshaya and W. F. Kenney. Jan. 1959. 6p. OTS.

The solubility of Xe in liquid Bi containing 0.085% U, 0.04% Mg, and 0.024% Zr was measured at 540°C. The results are expressed in terms of the constant K defined by the equation $x = pK$, where x is moles Xe per cm^3 solution and p is the pressure in atmospheres. Values of K were found to lie in the range 0.8×10^{-9} to 5.5×10^{-9} moles Xe/cm^3-atm, the average being 2.7×10^{-9}. (auth)

24658 CF-60-8-21
Oak Ridge National Lab., Tenn.
DESIGN PROCEDURE FOR A MINIMUM WEIGHT SPACE RADIATOR. R. J. Hefner. Aug. 1, 1960. 26p. OTS.

Radiators designed to dissipate the waste heat generated by nuclear power units in space vehicles contribute a major portion to the weight of the entire system. An investigation was performed to determine the radiator configuration yielding the minimum-weight metal-vapor condenser, and the equations for the determination of the optimum values of the design parameters for the radiator configuration which appeared to be the best are presented. (auth)

24659 CRNP-946
Atomic Energy of Canada Ltd., Chalk River, Ont.
CRYSTAL DYNAMICS OF LEAD. B. N. Brockhouse, T. Arase, G. Caglioti, M. Sakamoto, R. N. Sinclair, and A. D. B. Woods. Aug. 16, 1960. 44p. (AECL-1074). AECL.

For presentation at the Symposium on Inelastic Scattering in Solids and Liquids, Vienna, October 11-14, 1960.

Frequency wave number dispersion curves for Pb at 100°K were measured in the $[\zeta,0,0]$, $[\zeta,\zeta,\zeta]$, $[\zeta,\zeta,0]$, and $[\zeta,1,0]$ directions of the reduced zone. At 296 and 425°K, dispersion curves for the $[\zeta,0,0]$ and $[\zeta,\zeta,\zeta]$ directions were determined. Most experiments were performed with a crystal spectrometer, using the "constant Q" method. Dispersion relations exhibited local minima at (1,0,0) which led to extra critical points in the frequency distribution. The frequencies mostly decreased with increasing temperature, longitudinal more slowly than transverse. The existence of high Fourier components was in some cases definitely established. Only slight evidence was found for Kohn anomalies in the dispersion curves. Energy widths of the neutron groups increased for fairly large Q with increasing temperature. A phenomenological theory of phonon lifetimes is formulated. (C.J.G.)

24660 CWR-700-10
Curtiss-Wright Corp. Research Div., Quehanna, Penna.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF COMPACT CHARGE IONIZATION. Final Report. E. N. Petrick, O. K. Husmann, and H. W. Szymanowski. June 1, 1960. 179p. Contract NOnr-2886 (00).

The objective of the program was primarily to investigate charge-exchange (surface) ionization. Diffusion flow-rate tests with inert gases and ionization tests with Cs were conducted using emitters of sintered-porous W, electro-formed Mo screen, and micro-perforated Pt plate. Excellent correlation was demonstrated between measured ion current and the predicted value based on diffusion data. The effect of surface diffusion flow was shown to be negligible. Cesium corrosion tests demonstrated the high-temperature long-term suitability of various materials, including W, Mo, and Al_2O_3. In regard to fabrication of the ion source, a promising technique of brazing the sintered porous W emitters into a Mo holder was developed. The generation of Cs within the fuel supply system was investigated in order to reduce fuel storage and handling problems. A Cs recovery of 89% of theoretical was measured. Data are included on the various phases of the investigation described above and specific recommendations are presented. (auth)

24661 DOFL-TR-821
Diamond Ordnance Fuze Labs., Washington, D. C.
SPECIFICATION OF ZIRCONIUM FOR USE IN GASLESS MIXTURES. R. E. McIntyre and M. L. Couch. Mar. 9, 1960. 37p. DOFL Project 30200. (AD-234317).

An investigation was made to determine the relationship between the properties of zirconium powder and the properties of heat powders or delay compositions and to arrive at a suitable specification. Seventeen samples were examined. The data show that the important points to be specified are the total zirconium content, the ignition gain, the hydrogen content, the particle-size distribution, and the surface area. A relationship was found between the calorific value of a mixture, its composition, and the ignition gain of the zirconium used, and equations are given for calculation of calorific values. The data show that the burning rate of barium chromate-zirconium delay compositions depends primarily upon the calorific value and secondarily upon the composition. A specification for the procurement of zirconium suitable for heat or delay powder is included. (auth)

24662 DRTE-Publ.-1025
Canada. Defence Research Telecommunications Establishment, Ottawa.
PROCEEDINGS OF THE SYMPOSIUM ON PHYSICAL PROCESSES IN THE SUN-EARTH ENVIRONMENT, JULY 20-21, 1959. Mar. 1960. 402p.

Abstracts were prepared for 11 of 34 papers pertaining to the origin and properties of cosmic rays, the Argus Project, Van Allen belts, and geomagnetic phenomena. (C.J.G.)

24663 DRTE-Publ.-1025(p.112-18)
Stanford Univ., Calif. and Stanford Research Inst., Menlo Park, Calif.
OPTICAL, ELECTROMAGNETIC, AND SATELLITE OBSERVATIONS OF HIGH-ALTITUDE NUCLEAR DETONATIONS, PART II. Allen M. Peterson.

The effects of Argus detonations on radio propagation was found to be minor. Auroral echoes were observed near the launch point and the conjugate point by 30-Mc radar equipment. Marked absorption of VLF propagation was observed over a path between England and Spain. Slight signal enhancements were noted over Pacific paths. Absorption of cosmic noise was not detected at 30, 60, or 120 Mc, nor was any shot-associated radio noise observed. (For part I see Nuclear Science Abstracts 13-20771.) (C.J.G.)

24664 DRTE-Publ.-1025(p.311-34)
Lockheed Aircraft Corp. Palo Alto, Calif. and Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies.
HYDROMAGNETIC THEORY OF GEOMAGNETIC STORMS. A. J. Dessler and E. N. Parker.

A hydromagnetic theory which explains the average characteristics of geomagnetic storms is summarized as follows. The magnetic storm is caused by a sudden increase in the intensity of the solar wind. Stresses are then set up in the geomagnetic field by the solar plasma imparting upon the earth's magnetic field and becoming trapped in it. These stresses, which are propagated to the earth as hydromagnetic waves, account for the observed average magnetic storm variations. The sudden commencement of the magnetic storm is due to a hydromagnetic wave generated by the impact of the solar plasma on the geomagnetic field. The initial phase of the magnetic storm, during which the magnetic field is above average intensity, is due to the increased solar wind pressure. During the initial phase, instability causes small plasma clouds to become imbedded in the magnetic field. These small clouds break up and diffuse into the magnetic field to form a belt of trapped particles from the sun (principally protons and electrons). The trapped protons set up stresses, mainly due to centrifugal force, which account for the main phase of the magnetic storm. The recovery from the main phase is attributed to the relief of the stress on the geomagnetic field by the transfer of the energy of the trapped protons to neutral hydrogen by means of ion-atom charge-exchange. The correct recovery time for the magnetic storm is predicted from the measured cross section of the ion-atom charge-exchange process and the hydrogen density values around the earth deduced from the scattering of solar Lyman-alpha radiation. (auth)

24665 GAMD-566
General Atomic Div., General Dynamics Corp., San Diego, Calif.
FREE EXPANSION OF A GAS. [PART] III. F. J. Dyson. Oct. 17, 1958. 11p. Project No. 52. Contract AF18(600)-1812.

A one-dimensional gas flow with the equation of state: $P = A\rho^\gamma$ is considered. The initial condition is a gas at rest with constant density ρ_0 and pressure P_0 filling a plane slab with a vacuum filling the outside region. An analytic solution was developed by the Courant-Friedrichs method for the problem of free expansion of the gas into the vacuum. (C.J.G.)

24666 LMSD-288140(Vol. I)(Paper 2)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
IONIC PROPULSION, AN ASSESSMENT. G. B. Shook, Paper 2 of GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME I. 34p.

This paper was originally published under the same title as LMSD-48456, dated Feb. 16, 1959.

A system composed of a nuclear reactor, a thermionic power convertor, and an ion motor for propulsion is discussed. It is shown that only the surface ionization type of motor holds any real promise; an optimum ratio of accelerating voltage to ion mass exists which is dependent on a compromise between fuel-mass to ship-mass ratio and time of flight; and a need exists for a lightweight thermal-to-electric power converter. As a result of a comparison made with chemical propulsion systems, it is concluded that for short trips payload deliverance capability is best with chemical fuel; whereas, for long (interplanetary) trips, ion propulsion is becoming increasingly better. Problem areas are pointed out and recommendations for future research on ion propulsion systems are made. (auth)

24667 LMSD-288140(Vol. I)(Paper 3)
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
A NUCLEAR-IONIC SYSTEM FOR SPACE FLIGHT. J. E. Cobb, G. B. Shook, and W. H. Cutler. Paper 3 of GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959 TO JANUARY 1960. VOLUME I. 32p.

A discussion is presented which is principally concerned with the development of an advanced power supply and its incorporation into a space ship. The design for a high-temperature reactor is combined integrally with a proposed thermionic power converter which, in addition, acts as the necessary heat sink, radiating waste heat to outer space. The electric power obtained from this integral design is then applied to an ion motor using the tungsten–cesium surface ionization principle. (W.D.M.)

24668 NAA-SR-5111
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
THE HEATS OF FUSION OF THE CADMIUM HALIDES, MERCURIC CHLORIDE, AND BISMUTH BROMIDE. L. E. Topol and L. D. Ransom. Sept. 1, 1960. 7p. Contract AT-11-1-GEN-8. OTS.

The heats of fusion of $CdCl_2$, $CdBr_2$, CdI_2, $HgCl_2$, and $BiBr_3$ were determined with a drop-calorimeter to be 7.22 ± 0.17, 7.97 ± 0.08, 4.95 ± 0.13, 4.64 ± 0.05, and 5.19 ± 0.20 kcal/mole, respectively. Heat capacities of the solid and liquid salts in the vicinity of the melting point were also determined. (auth)

24669 NASA-TN-D-488
National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECENT DIRECT MEASUREMENTS BY SATELLITES OF COSMIC DUST IN THE VICINITY OF THE EARTH. H. E. LaGow and W. M. Alexander. Sept. 1960. 14p. OTS.

Direct measurements of the space density of cosmic-dust particles in the vicinity of the earth were made from rockets, satellites, and space probes. Preliminary results from satellite 1959 Eta (Vanguard III) showed: (1) over 1500 impact impulses produced by dust-particle collisions on sensitive surfaces of space vehicles and an area-time product greater than 10^{10} cm^2-sec, and (2) a daily variation in the dust-particle density near the earth. The dust-particle instrumentation of 1959 Eta and sensor calibration techniques are discussed. The results of direct measurements from space vehicles prior to 1959 Eta are summarized with respect to 1959 Eta information. (auth)

24670 NASA-TN-D-491
National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IONOSPHERIC MEASUREMENTS USING ENVIRONMENTAL SAMPLING TECHNIQUES. R. E. Bourdeau, J. E. Jackson, J. A. Kane, and G. P. Serbu. Sept. 1960. 17p. OTS.

Methods for the direct measurement of ionization parameters in the ionosphere, exosphere, and interplanetary plasma were evaluated. The methods utilized: a radio-frequency impedance probe for the measurement of electron concentration, a Langmuir probe for electron temperature, and an ion trap for positive ion concentration. Performance of the instruments is discussed. (C.J.G.)

24671 NASA-TR-R-79
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
FAST INTERPLANETARY MISSIONS WITH LOW-THRUST PROPULSION SYSTEMS. W. E. Moeckel. 1960. 59p.

A simple family of indirect transfer trajectories between circular orbits is used to evaluate the mass ratio required to complete round-trip interplanetary missions using low-thrust propulsion systems. The results indicate that indirect interplanetary trajectories yield substantial reductions in total round-trip time for low-thrust as well as high-thrust vehicles, and that space vehicles propelled with electric rockets may produce greater reductions in trip time, for a given initial weight, than those propelled by high-thrust nuclear rockets. (auth)

24672 NP-8968
Naval Research Lab., Washington, D. C.
NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period for April–June 1960. July 1, 1960. 35p.

Research progress is reported in nuclear constituents and structure and in nuclear instrumentation and technology. Separate abstracts were prepared for the four sections of the report. (For preceding period see NP-8841.) (W.D.M.)

24673 NP-8968(p.1-10)
Naval Research Lab., Washington, D. C.
AN EXTENSION OF THE VARIATIONAL METHOD FOR HARD-SPHERE BOSONS. R. J. Drachman.

A variational treatment was developed for the problem of the infinite-volume many-boson system, and the first two terms in a series solution for the ground-state energy of the boson hard-sphere system have been calculated. The investigation is extended to include discussion of one or more terms in the series, which was overlooked in earlier exact calculations. The relation between the variational wave function and that obtained using the pseudopotential method is discussed. (W.D.M.)

24674 NP-8968(p.18-27)
Naval Research Lab., Washington, D. C.
HIGH CURRENT DENSITY METALLIC THERMIONIC EMITTERS. H. F. Kaiser.

The need for electron beams of current strength in the kiloampere regime, as required in the study of electron-beam pinch or contraction effects, and the utilization of such electron beams in producing magnetic fields for particle-accelerator guide fields or thermonuclear machines has emphasized the need for electron sources which are capable of producing such currents. The possibilities of high-temperature thermionic emission are examined. (W.D.M.)

24675 NP-8968(p.28-32)
Naval Research Lab., Washington, D. C.
NANOSECOND SPARK-GAP OBSERVATIONS. T. F. Godlove.

In connection with a study aimed at the development of a particular type of pulse generator some interesting observations were made of medium-current (10 to 400 a) short-duration (30 to 100 ns) sparks. Pulses having a rise-time of 2 to 10 ns were observed with a simple low-inductance wide-band spark-gap circuit with the voltage set slightly above the spontaneous breakdown level. (W.D.M.)

24676 NP-8982
Space Technology Labs., Inc. Physical Research Lab., Los Angeles.
A MAGNETICALLY INSULATED SHOCK TUBE. Richard G. Fowler and Eugene B. Turner. [1960]. 48p. (STL/TR-60-0000-09180).

Experimental results obtained with a magnetically insulated shock tube are presented. The 1-in.-diameter tube is enclosed by a solenoid field coil which produces a longitudinal magnetic field of up to 20,000 gauss throughout both the electrical discharge and expansion chambers. Peak currents of up to 95,000 amp are produced in the discharge tube by a 50-μf capacitor bank charged up to about 8 kv. The electrical characteristics of the discharge were determined from voltage and current signals. The magnetic field was found to substantially reduce the attenuation of the shock wave moving down the tube, presumably by a reduction of the boundary layer thickness behind the shock wave. With a magnetic field strength of 7500 gauss and higher, a contact surface, such as occurs in diaphragm type shock tubes, is clearly defined in the wave speed pictures, while at zero and low magnetic field strengths the contact surface is not visible. There was evidence from the reflected shock velocities and from the convex shape of the shock front that the magnetic field was inhibiting the degrees of freedom perpendicular to the field lines resulting in a gas with a higher effective γ. (auth)

24677 NP-9006
Italy. Comitato Nazionale per le Ricerche Nucleari, Frascati Laboratori.
ACTIVITY AT THE NATIONAL LABORATORIES OF FRASCATI. Report No. 8 for the period December 1959–June 1960. June 24, 1960. 62p.

Modifications and improvements made to the electron synchrotron are detailed. Construction of a storage ring is discussed. Activities of the various laboratories are summarized. This activity is mainly concentrated on problems connected with nuclear research done with the synchrotron or on its development and improvement. All experiments that have been set up in the experimental area are described. (W.D.M.)

24678 NP-9013
Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.
DISCRIMINATION OF TRACKS OF PHOTOFISSION FRAGMENTS WITH VERY HIGH BACKGROUND OF ALPHA PARTICLES AND ELECTRONS IN NUCLEAR EMULSIONS. H. G. de Carvalho and A. G. da Silva. 1960. 11p. (Notas de Física Vol. VI, No. 1).

With common chemicals used in photography such as Amidol, boric acid, sodium sulfite, and potassium bromide, a developing bath was prepared which permits a full discrimination between tracks of highly ionizing particles, such as fission fragments, in the presence of strong background radiation such as 10^9 alpha particles per cm^2 or by the electrons from a 2000-r x-ray source. (auth)

24679 ORNL-2975
Oak Ridge National Lab., Tenn.
SOME PROPERTIES OF INFINITE, LUMPED SOLENOIDS. G. R. North. Sept. 1, 1960. 18p. Contract W-7405-eng-26. OTS.

The ripple characteristics of infinite-lumped solenoids are treated by a Fourier analysis. The transition from finite to infinite systems is pointed out. The coefficients in the resulting Fourier series for an infinite set of coaxial, equal current-bearing loops are solved for exactly. For loop radii, R, large compared to the spacing distance, λ, an approximate form for B_z on the axis is $B = B_{SOL} (1 + 2\pi\sqrt{(R/\lambda)} \cdot e^{-2\pi(R/\lambda)} \cos (2\pi/\lambda) z)$, $R \gg \lambda$, where B_{SOL} is the field owing to an infinite, uniform solenoidal current sheet. The calculation is extended to points off the axis. An approximate solution is also found for an infinite set of rectangular coils. (auth)

24680 RMD-1155-S3
Thiokol Chemical Corp. Reaction Motors Div., Denville, N. J.
HEAVY PARTICLE PROPULSION RESEARCH. Report Period: January 1, 1960 to April 30, 1960. Douglas M. Jamba. 38p. Project RMD 1155. Contract AF49(638)-657. (AFOSR-TR-60-70).

Objectives of the work are the generation, charging, and acceleration of 300- to 10^6-amu particles to determine the characteristics of particle beams as they may apply to advanced electric propulsion systems. Many types of mechanisms were tested to charge, hold, and feed previously prepared solid-metal powders with the end purpose of obtaining a continuous beam of charged particles having an average specific charge in the range of 1 to 100 coulombs/kg. Several measurement systems and techniques were investigated to determine their advantages and limitations. No one system was found that could be used for general comparison and evaluation of charged-particle beam properties. (For preceding period see RMD-1155-S2.) (W.D.M.)

24681 SCTM-258-60(14)
New Mexico State Univ., University Park.
CHARGED CYLINDRICAL TUBE. T. R. Ferguson and R. H. Duncan. June 30, 1960. 34p. For Sandia Corp. OTS.

A Fourier series solution for the charge density on a cylindrical tube is developed in such a way that the Fourier coefficients are the unknowns in a system of linear equations. Numerical results are obtained for a tube of half length to radius ratio of 25 π. Results compare favorably with existing similar problems. (auth)

24682 TID-6391
Case Inst. of Tech., Cleveland.
SOLID STATE PHYSICS PROGRAM. TEMPERATURE

VARIATION OF SPONTANEOUS MAGNETIZATION IN THIN IRON FILMS. Technical Report No. 8. King H. Rosette. Apr. 1960. 40p. Contract AT(11-1)-623. OTS.

An anomalous temperature dependence of the intensity of magnetization of thin Fe films of various thicknesses was observed with a magnetization loop tracer. Films of thickness 26 A to 1020 A were studied from about 10°K to room temperature. The similarity with the experimental behavior of some bulk ferrimagnetic oxides and the high electrical resistivities suggest significant oxidation. Below a thickness of approximately 100 A the magnetization-temperature curves indicate an increasing ferrimagnetic contribution with decreasing thickness. In fact, the strong influence of the oxides on the magnetization-temperature behavior causes the room-temperature magnetization to be significantly less dependent on film thickness than is predicted by the Klein-Smith spin wave theory for ferromagnetic films. Thicker films showed the expected temperature dependence for the reduced magnetization, M/M_0. However, all films had a magnetization less than the bulk value. (auth)

24683 TID-6583

Princeton Univ., N. J. Plastics Lab. and Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.

THERMODYNAMIC SERIAL ORDER OF THE METALS AT HIGH TEMPERATURE. Technical Report 58C. Herbert A. Pohl. July 1, 1960. 14p. Contracts DA-36-039sc-78105 and AT(07-2)-1. OTS.

Heats of formation and free energy were calculated for metal oxides, fluorides, chlorides, and sulfides at 298.16°K, and the resulting values were tabulated to form a thermodynamic order replacement series. The effect of the change in free energy per mole of reactant upon dilution in a "perfect solution" is demonstrated graphically. (C.J.G.)

24684 TID-7586(Pt. 1)

Oak Ridge National Lab., Tenn.

HIGH TEMPERATURE THERMOMETRY SEMINAR HELD OCTOBER 1-2, 1959 AT OAK RIDGE NATIONAL LABORATORY. W. R. Grimes and D. R. Cuneo, eds. Aug. 1960. 175p. OTS.

Information contained in papers presented at a thermometry seminar is summarized. Included are papers and discussion on high-temperature thermometry, measurement of high temperatures in engineered systems, temperature measurement in nuclear radiation fields, and temperature measurement in operating reactors. Separate abstracts were prepared for 17 of the 18 included papers. (J.R.D.)

24685 TID-7586(Pt. 1)(p.1-15)

Oak Ridge National Lab., Tenn.

SOME RESULTS OF BASE-METAL THERMOCOUPLE RESEARCH AT OAK RIDGE NATIONAL LABORATORY. J. F. Potts and D. L. McElroy.

A discussion of research on cause-effect relations in base-metal thermocouples, particularly niobium-base alloys for use at 1000 to 2000°F is presented. One phase of this work centers around the possible in-service precipitation of chromium carbide in Chromel-P, which was reported to cause an increase in the thermal emf of these wires after time-temperature histories. Another study involves the use of a unilateral temperature gradient furnace in which Chromel-P/Alumel couples were used to measure small temperature differences. A third reported study is on binary solid solution alloys of nickel and silicon. Results of static drift tests on these alloys at 980°C for 1000 hr are presented graphically. Other aspects of this program are included in report ORNL-2773. (J.R.D.)

24686 TID-7586(Pt. 1)(p.16-22)

Hoskins Mfg. Co., Detroit.

EFFECT OF ENVIRONMENT ON THE STABILITY OF CHROMEL/ALUMEL THERMOCOUPLES. Forbes S. Sibley.

Research concerning the shift in calibration which occurs in the chromel leg of Chromel/Alumel thermocouples in relatively short periods when the alloy is exposed to marginally oxidizing atmospheres at 1500 to 1800°F is discussed. The trend toward higher temperature and finer wires, coupled with increasing requirements for greater emf stability in Chromel/Alumel thermocouples exposed to oxidizing atmospheres is also discussed. (J.R.D.)

24687 TID-7586(Pt. 1)(p.23-30)

Honeywell Research Center, Hopkins, Minn.

UNIQUENESS OF THERMAL EMF'S MEASURED IN MOLYBDENUM, RHENIUM, TUNGSTEN, IRON, AND COPPER. F. W. Kuether.

A qualitative comparison of the thermoelectric departures of Mo, Re, W, Fe, and Cu is presented. Copper is, as a material, the most nearly unique. However, an individual wire of tungsten is the most nearly unique material among those studied. Iron and rhenium have a comparable departure from a unique thermal emf. Their departure is somewhat greater than that of copper and tungsten. Molybdenum is considered comparable with rhenium. Thermoelectric classification is discussed, and it is noted that thermocouple accuracy can be improved by two decades using thermoelectric classification. (J.R.D.)

24688 TID-7586(Pt. 1)(p.37-43)

General Electric Co. [Instrument Dept.,] West Lynn, Mass.

HIGH-OUTPUT NOBLE-METAL THERMOCOUPLES AND MATCHING LEAD WIRE. R. B. Clark and W. C. Hagel.

An investigation of Pt–Ir/Pd, Rh/Pd, and Chromel/Pd thermocouple performance for use in combustion chambers is described. Efforts to increase thermoelement purity in which values of 99.90% were achieved for Pt, Ir, and Pd and which resulted in a system accuracy of ±0.75% are discussed. Thermoelement combination stability is discussed, and research directed toward higher thermocouple outputs and applications at higher temperatures is outlined. (J.R.D.)

24689 TID-7586(Pt. 1)(p.44-52)

National Carbon Co., Parma, Ohio.

HIGH-TEMPERATURE THERMOCOUPLES BASED ON CARBON AND ITS MODIFICATIONS. N. R. Thielke and R. L. Shepard.

A review of developmental work on C-base thermocouples is presented. Data on voltage output versus temperature for various combinations are presented graphically and data on these couples obtained from literature are tabulated. (J.R.D.)

24690 TID-7586(Pt. 1)(p.53-68)

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

DISTRIBUTED SEEBECK EFFECT AT HIGH TEMPERATURES. R. J. Freeman.

Highlight information on the hot zone error caused by the "Distributed Seebeck Battery" is presented. The discussion is centered primarily around the Pt–Pt/10% Rh system; however, it is noted that the effect was observed in other thermoelectric systems. Data and illustrations are included. It is concluded that the hot zone error voltage is a function of parameters such as size and geometry of the sensor, hot junction and hot zone temperatures, hot zone configuration, properties of the insulating material, and the type of thermoelectric system or systems involved. (J.R.D.)

24691 TID-7586(Pt. 1)(p.69-80)
Warner & Swasey Co. Control Instrument Div.,
New York.
MONOCHROMATIC RADIATION PYROMETRY FOR GAS TEMPERATURE MEASUREMENT. Richard H. Tourin.

The characteristics of monochromatic radiation pyrometry, and some results achieved by its use for gas-temperature measurement, are described. Among the major characteristics of this method are sensitivity to infrared radiation which is emitted by hot gases from all fuels, ability to measure absolute temperature, and its adaptability to direct indicating and recording. (J.R.D.)

24692 TID-7586(Pt. 1)(p.81-94)
Warner & Swasey Co. Control Instrument Div.,
New York.
A DICHROMATIC RADIATION PYROMETER. Richard H. Tourin.

The dichromatic radiation pyrometer makes use of the fact that emission of infrared radiation varies with temperature and this variation is different for different wavelengths in the spectrum of hot objects. The instrument is so designed that it measures radiation at two wavelengths from the same area of the hot object. Changes in the ratio of the emission intensities at these wavelengths are used to indicate temperature. Other design features are also described along with calibration procedure and applications. (J.R.D.)

24693 TID-7586(Pt. 1)(p.95-9)
Westinghouse Electric Corp. Bettis Atomic Power Div.,
Pittsburgh.
RELIABILITY ASSURANCE IN SHEATHED THERMOCOUPLES FOR NUCLEAR REACTORS. H. George Johannessen.

The development of sheathed thermocouples is described. Specification evolution is discussed along with procedure for assuring reliability of these thermocouples in reactors. Tests for sheath, electric, and thermoelectric reliability are outlined. (J.R.D.)

24694 TID-7586(Pt. 1)(p.100-9)
Oak Ridge National Lab., Tenn.
THERMOCOUPLES FOR MEASUREMENT OF TEMPERATURES OF GAS-COOLED SURFACES. W. E. Browning and H. L. Hemphill.

Fabrication of thermocouples for measuring the temperature of gas-cooled surfaces is described. These thermocouples require a correction of only 15 ± 10°C while measuring surface temperatures of 800°C in cold air at 300 ft/sec velocity. Thermocouples of this type are accurate, mechanically reliable, and their thermal data is reproducible. (J.R.D.)

24695 TID-7586(Pt. 1)(p.110-19)
Arnold Engineering Development Center, Tullahoma,
Tenn.
HEAT TRANSFER MEASUREMENTS IN AN ELECTRIC-ARC DRIVEN WIND TUNNEL. R. L. Ledford.

Measurement of heat transfer during operation of the Arnold Engineering Development Center wind tunnels, in which stagnation temperatures range from 4000 to 10,000°K and the stagnation pressures are near 15,000 psia, is discussed. A transducer is used to sense the resistance of a copper slug without attaching the wires directly to it. In another modification a thermistor is used as the calorimetric mass. Design and calibration of these temperature-measuring devices are described. (J.R.D.)

24696 TID-7586(Pt. 1)(p.120-9)
Oak Ridge National Lab., Tenn.
CHANGES IN EMF CHARACTERISTICS OF CHROMEL/ALUMEL AND PLATINUM/PLATINUM-RHODIUM.
M. J. Kelly.

Experiments are described in which thermocouples were exposed to neutron irradiation for long periods of time and then recalibrated against similar unirradiated thermocouples. Results are discussed and tentative conclusions are given. (J.R.D.)

24697 TID-7586(Pt. 1)(p.130-9)
Oak Ridge National Lab., Tenn.
LITR EXPERIMENTS RELATING TO RHENIUM/TUNGSTEN AND PLATINUM/PLATINUM-RHODIUM THERMOCOUPLES. D. B. Trauger.

Experiments are described in which Pt/Pt-10% Rh and Re/w thermocouples were used to measure temperatures at 1500 to 2600°F for in-pile measurements on various concentrations of fission products for periods up to 30 weeks. Data on thermocouple behavior are tabulated. The Re/w thermocouples were found to be considerably more stable than the Pt-Pt/Rh and appear to be operable above 3000°F. (J.R.D.)

24698 TID-7586(Pt. 1)(p.140-3)
Oak Ridge National Lab., Tenn.
A SUMMARY OF EXPERIENCE WITH IN-PILE THERMOCOUPLES. J. C. Wilson.

In a summary of thermocouple behavior in in-pile experiments it is noted that radiation effects on temperature-emf curves appear to be negligible for most applications; however, this may not be true for certain experiments. Thermocouple reliability appears to depend mostly on the use of the thermocouple and its insulation. Methods of minimizing transmutation damage are discussed. (J.R.D.)

24699 TID-7586(Pt. 1)(p.144-56)
Knolls Atomic Power Lab., Schenectady, N. Y.
ERROR ANALYSIS OF PLATE TYPE FUEL ELEMENT TEMPERATURE MEASUREMENTS. J. A. McCann.

Temperature-measurement errors caused by reactor core design requirements are discussed. The following potential sources of error are listed: gamma heating, internal thermocouple heating, thermal gradient effects, and inability to accurately locate thermocouples in plates. Equations are included which permit calculation of expected accuracies in predicting single fuel-element temperatures from single measurements in steady-state reactor core operation. (J.R.D.)

24700 TID-7586(Pt. 1)(p.157-67)
Advanced Technology Labs. Div. of American-Standard,
Mountain View, Calif.
TEMPERATURE INSTRUMENTATION OF METALLIC URANIUM FUEL PINS. Dieter L. Rall.

The development of a technique for embedding thermocouples in uranium fuel pins by recasting the uranium around the thermocouple using a zone-melting technique is described. The center temperature of the pins can be measured by such thermocouple placement with a location accuracy of ±0.003 in., and at temperatures of 0 to 2060°F. (J.R.D.)

24701 TID-7586(Pt. 1)(p.168-71)
National Bureau of Standards, Washington, D. C.
PROGRESS ON DEVELOPMENT OF A REFERENCE CURVE FOR THE IRIDIUM VERSUS 40% IRIDIUM-60% RHODIUM THERMOCOUPLES. G. F. Blackburn and F. R. Caldwell.

Progress in a program in which Ir-Ir 40%/Rh 60%

wires were calibrated at temperatures up to 3000°F is described. Experimental techniques are described, and resulting data are tabulated. (J.R.D.)

24702 UCRL-5819-T
Stanford Research Inst., Menlo Park, Calif.
DIAGNOSTIC METHODS FOR SPACE POTENTIALS IN ION BEAMS. T. O. Passell. Feb. 15, 1960. 44p. For Univ. of California Lawrence Radiation Lab. Contract W-7405-eng-48, Subcontract No. 122. OTS.

The electric fields due to space charge in a positive ion beam were measured by observing the deflection of a nearby electron beam. A geometry was used wherein electron-beam deflection occurred by the $\vec{E} \times \vec{B}$ drift mechanism. Other qualitative methods of measurement are described. The $\vec{E} \times \vec{B}$ deflection method is applicable to several geometries and to both pulsed and to d-c systems. The study showed the output beam of a pulsed, 3- to 8-kev, titanium hydride, H^+ ion source to be substantially unneutralized 180° around the first circular orbit from the source. This condition existed when the source was pulsed in an ambient vacuum of 3×10^{-7} mm Hg. (auth)

24703 WADC-TR-59-607
Aerojet-General Nucleonics, San Ramon, Calif.
STANDARDIZATION OF FABRICATION TECHNIQUES (THRESHOLD FOILS). [Period covered]: January 1958 to September 22, 1959. I. E. Lamb and R. R. Tsukimura. Dec. 18, 1959. 100p. Project No. 6002. Contract AF33(600)-35917. OTS.

Techniques used to develop and standardize a series of neutron-detection foils for measurement of neutron spectra are described. The series includes gold and cobalt foils, and Pu^{239}, U^{238}, and sulfur threshold foils. A method of calibrating the foils with a low-flux research reactor is discussed. The instrumentation required to obtain data from the foils is presented, together with the neutron intensities that may be explored with these detectors. (auth)

24704 ACSIL-Trans-834
CONCERNING THE NEUTRALISATION OF THE SPACE CHARGE OF POSITIVE ION BEAMS BY ELECTRON ACCUMULATION STUDY OF THE TIME TAKEN FOR NEUTRALISATION. René Bernas, Louis Kaluszyner, and Jean Druaux. Translated from J. phys. radium 15, 273-80 (1954). 14p. (ACSIL/ADM/56/563).

A simple experimental method permits the study of the compensation of the space charge in concentrated beams of positive ions. The existence and the variation of the time T required for compensation enable the role of the electrons and their method of production in this process to be established. The measurements obtained for T vary from 30 to 200 μsec according to the condition. A few practical consequences of these experiments are discussed. (auth)

24705 AEC-tr-4193
THE SPREAD OF AIR AND GROUND FIELDS FOR HIGH VOLTAGE CONDUCTANCE ESPECIALLY WITH GROUND CONNECTIONS AND SHORT CIRCUITS. Reinhold Rudenberg. Translated by Margaret L. Schloo from Elektrotech. Z. 46, 1342-6(1925). 13p. JCL.

The effects of star-point grounding on overvoltage and excess current are discussed. Induction potentials in adjacent circuits with normal alternating current operation and triple harmonics with grounded star points are examined. Magnitude of the ground current with small and large grids and its behavior at ground connections with star-point grounding are also examined along with the course of current in the ground. The concentration at the electrodes and in the narrow zone under the conductor are considered and the current displacement, resistance, and self-inductance of the ground current were measured. The hazards of stepped current and the magnitude of the danger zones are outlined. Protective measures by double conductors and the effects of grounded protective lines are discussed. (auth)

24706 AEC-tr-4200
FLUORESCENT L SPECTRUM OF PLUTONIUM. (Spectre de Fluorescence L du Plutonium). Yvette Cauchois and Iona Manescu. Translated by Gretchen Riese and R. E. Tate (Los Alamos Scientific Lab.) from Compt. rend. 242, 1433-6(1956). 4p. JCL.

The observations previously made on the absorption spectra and four emission lines of plutonium using about 10 mg of PuO_2 were extended to about 20 new emissions. (auth)

24707 AEC-tr-4211
CHARACTERISTIC MULTIPLETS OF THE X EMISSION SPECTRA OF THE RARE EARTHS. (Multiplets Caracteristiques des Terres Rares Dans Leurs Spectres d'Emission X). Paul Sakellaridis. Translated by Gretchen Riese and Robert McDonald (Los Alamos Scientific Lab.) from J. phys. radium 16, 422-7(1955). 11p. JCL.

The existence of the incomplete 4f level in the rare-earth elements gives rise to the very characteristic anomalies of the x-ray spectra. The emission lines that do not exist for the other elements have been reported for the rare-earth region. Moreover, degradations of certain generally close dipolar emissions are observed. The results of a systematic study of the emission and multiplet characteristic of the L spectrum of the elements are given. (auth)

24708 AEC-tr-4212
X SPECTRA OF PLUTONIUM AND LEVELS OF ENERGY OF THE TRANSURANIUM ELEMENTS. (Spectres X du Plutonium et Niveaux d'Energie des Elements Transuraniens). Yvette Cauchois. Translated by Gretchen Riese, Robert McDonald, and Donald Collins (Los Alamos Scientific Lab.) from J. phys. radium 16, 81s-83s(1955). 7p. JCL.

Experiments are described in which the L absorption spectrum of $Pu^{239}O_2$ was investigated. An assembly that permitted the use of an x-ray tube with interchangeable anticathodes to produce a continuous spectrum for absorption or emissions of known frequencies for reference was used. A list of values based on the measurements beginning at the L_{III} discontinuity and from the emission transitions was made as had previously been done on elements 92 and 93. Values calculated by the least-squares method in the quadratic approximation, based on values for elements 81, 82, 83, 88, 90, and 92, are also given. (J.R.D.)

24709 AEEW-Trans-1
NEUTRON DENSITY MEASUREMENTS BY AUTORADIOGRAPHY OF DETECTOR FOILS. A. Ertaud and P. Zaleski. Translated by D. J. Wilson (U.K.A.E.A., Winfrith) from J. phys. radium 14, 191-7(1953). 19p.

A method is given for measuring neutron density which consists of making a β-ray autoradiograph of a thin detector irradiated in the neutron flux to be examined. Descriptions of the preparation and standardization of the detectors and the choice and standardization of the emulsion are given. The method is very sensitive and very precise, particularly adapted for measuring very rapid flux variation occurring over a short distance. In particular it appears to suit the experimental study of the behavior of neutrons in the neighborhood of strong absorbers or in a region in which there are many materials of very different nuclear qualities and of small dimensions (e.g., reactor core cells). (auth)

24710 CEA-tr-R-841
CROISSANCE DES CRISTAUX D'IODURE DE CÉSIUM ET ÉTUDE DE LEURS PROPRIÉTÉS LUMINESCENTES. (Growth of Cesium Iodide Crystals and Study of Their Luminescence Properties). N. K. Pereyaslova (Perejaslova) and G. A. Kirdina. Translated into French from Pribory i Tekh. Ekspt. No. 5, 86-90(1958). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2954.

24711 CEA-tr-R-901
AUTOACCÉLÉRATION PAR INDUCTION D'UN FLUX DE PARTICULES CHARGÉES. (Self Acceleration by Induction of a Charged Particle Flux). G. A. Askar'yan (Askarian). Translated into French by B. Vinogradoff from Atomnaya Energ. 6, 658-9(1959). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 18276.

24712 JPRS-5154
TENTH ALL-UNION CONFERENCE ON NUCLEAR SPECTROSCOPY. O. Kraft. Translated from Atomnaya Energ. 8, 378-80(1960). 9p. OTS.

The following subjects are covered briefly: beta decay; nuclear reactions; nuclear distortion theory; neutron-deficient isotopes of rare earths; gamma processes; and technique of nuclear spectroscopy. (W.L.H.)

24713 JPRS-5346
IONIZED GAS AND HIGH-SPEED ELECTRONS IN THE VICINITY OF THE EARTH AND IN INTERPLANETARY SPACE. K. I. Gringauz, V. G. Kurt, V. I. Moroz, and I. S. Shklovskii (Shklovskiy). Translated from Doklady Akad. Nauk S.S.S.R. 132, 1062-5(1960). 14p. OTS.

An analysis of experimental data obtained during the flight of the second Soviet cosmic rocket is reported. Measurements are presented on ionized gas and high-speed electrons from the earth to 70,000 km in space. (W.L.H.)

24714 SCL-T-330
DEVELOPMENT OF PRESSURE WAVE BY AIR EXPLOSION. (Nyomáshullám Kialakulása Légrobbantásnál). J. Gálfi, F. Gellert, and L. Sédy. Translated by Peter Szeman (Sandia Corp.) from Geofiz. Közlemények 4, No. 2, 41-4(1955). 5p. JCL.

A method for the study of pressure ratios developed by freely-exploding explosives, using a photographic procedure adapted from seismic experiments, is described. (J.R.D.)

24715 UCRL-Trans-554
MAGNETIC AND THERMAL PROPERTIES OF THREE MODIFICATIONS OF SOLID OXYGEN. A. S. Borovik-Romanov, M. P. Orlova, and P. G. Strelkov. Translated from Doklady Akad. Nauk S.S.S.R. 99, 699-702(1954). 7p. JCL or LC.

Results of a study are reported in which the three modifications of solid oxygen were examined. Heat capacity measurements were made with a vacuum calorimeter in the vicinity of phase transition points, and the magnetic susceptibility of this element was measured at 26.5 to 77.5°K. Interaction between magnetic moments in the liquid and in the γ-modification is considerable, and has a negative sign. During the transition into the β-modification the susceptibility drops sharply. These data lead to the conclusion that because of the density increase that accompanies the $\gamma \rightleftharpoons \beta$ transition, the exchange interaction is so strong that the β-modification becomes antiferromagnetic. (J.R.D.)

24716
THE RANGE OF ALKALI METAL IONS OF KILOELECTRON VOLT ENERGIES IN ALUMINUM. J. A. Davies, J. D. McIntyre, R. L. Cushing, and M. Lounsbury (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Chem. 38, 1535-46(1960) Sept.

A simple electrostatic accelerator capable of producing a monoenergetic beam of alkali metal ions at energies up to 100 kev was used to study the range of Cs^{137} ions in aluminum as a function of energy. The median range increased linearly with energy as predicted from the Bohr-Nielsen equation but had a value about twice that predicted by this equation. Furthermore, the observed straggling about the mean value was not Gaussian in shape but consisted of an asymmetric peak with a pronounced exponential "tail." The possible significance of these results is discussed. Preliminary results are given for the range of 30-kev Rb^{86} and Na^{24} ions in aluminum. (auth)

24717
VELOCITY AUTOCORRELATIONS OF CHARGED PARTICLES IN A MAGNETOIONIC MEDIUM WITH APPLICATIONS TO TURBULENT DIFFUSION. R. C. Bourret (Hughes Aircraft Co., Malibu, Calif.). Can. J. Phys. 38, 1213-23(1960) Sept.

A system of charged particles in a slightly ionized medium was considered subject to collisions with members of the neutral species; a constant external magnetic field; and a fluctuating force field, either external or representing the collision forces. On the assumption that their motions are satisfactorily described by the Langevin equation, the cross-correlation functions in time between velocity components of these charged particles are calculated. These functions may be used to describe the self-diffusion of the charged particles. The cases treated are purely random external forcing, forcing by exponentially correlated (Markovian) forces, and forcing by a random series of pulses corresponding to collision forces. (auth)

24718
ANALYSIS OF SOME CRITERIA FOR THE COMPARISON OF THE PROPERTIES OF AEROSOLS. F. Shubart (Military Academy, Brno). Collection Czechoslov. Chem. Communs. 25, 1961-4(1960) July. (In Russian)

Some criteria for the comparison of aerosols are mentioned, and the mean size of the particles is defined in various manners. Their comparisons with each other are analyzed. (tr-auth)

24719
THE SECONDARY EMISSION FROM INCANDESCED METAL UNDER THE ACTION OF CESIUM AND POTASSIUM IONS. N. N. Petrov (Leningrad Polytechnic Inst.). Fiz. Tverdogo Tela 2, 949-58(1960) May. (In Russian)

The secondary emission from a heated molybdenum target bombarded by cesium ions with energies of 0.2 to 1.4 kev was studied. A linear increase of the γ coefficient with ion energy was observed. The reflected ion spectrum contains positive particles with energies up to 100 ev at an incident energy E = 1 kev. The secondary emission from tantalum and tungsten targets at temperatures up to 2000°K was investigated. Electron stripping does not take place at ion energies less than 1.5 kev; electron stripping begins at $E \simeq 1.5$ kev. Moreover, γ increases linearily with energy, reaching 24 to 26% when E = 6 kev. A dip found in the plot $\gamma = f(E)$ did not depend on target material or temperatures up to 1700 to 2000°K and was found to be identical for tantalum and tungsten targets. (R.V.J.)

24720
THE PHOTOELECTRIC STATE IN ZnS AND TWO NEW ELECTROPHOTOGRAPHIC PROCESSES. B. M. Golovin,

N. T. Kashukeev, I. N. Orlov, and V. M. Fridkin (Moscow Inst. of Crystallography, Academy of Sciences, USSR). Fiz. Tverdogo Tela 2, 1004-10(1960) May. (In Russian)

The photoelectric state and the luminescence in polycrystalline ZnS activated by copper and chlorine were studied, using ZnS powder dispersed in polystyrene and pressed into 1-mm-thick, 1-cm-wide tablets. The relation of photoelectric charge to time spent in darkness (dark depolarization) was investigated, and curves of dark polarization were plotted as a function of emission energy during the excitation. (R.V.J.)

24721

SOME PECULIARITIES OF HEAT STIMULATED CONDUCTIVITY IN CdS SINGLE CRYSTALS. A. P. Trofimenko, G. A. Fedorus, and A. K. Razmadze (Inst. of Physics, Academy of Sciences, Kiev). Fiz. Tverdogo Tela 2, 1141-7 (1960) June. (In Russian)

The temperature dependence of the electron-capture cross section of CdS(S) monocrystals was determined, and the trap saturation magnitude was experimentally verified at the thermally stimulated conductivity maximum. The photosensitivity was correlated with the regions under the thermal stimulation conductivity curves. The effects of etching and glow discharge treatment on thermally stimulated conductivity were determined. (tr-auth)

24722

INVESTIGATION OF KINETICS OF INFRA RED IMPURITY PHOTOCONDUCTIVITY IN CdS, INDUCED BY PRELIMINARY ILLUMINATION. E. N. Arkad'eva, L. G. Paritskiĭ, and S. M. Ryvkin (Leningrad Inst. of Physics and Tech.). Fiz. Tverdogo Tela 2, 1160-8(1960) June. (In Russian)

The photoconductivity of CdS monocrystals in the 2 to 4 μ infrared region was studied at 77°K. It is postulated that infrared photoconductivity is related to electron transitions into the conductance region at adhesive levels. The cross section for photon capture by charge centers, the coefficient of light absorption in the infrared region, and the adhesive saturation levels are determined on the basis of a model developed by correlating experimental data on infrared photoconductivity kinetics. Also, the concentration of levels, their positions in forbidden zones, and their cross section for electron capture from the conducting zone are evaluated. (tr-auth)

24723

ON THE INTERACTION OF ACOUSTIC VIBRATIONS IN THE IONIC AND ELECTRONIC-IONIC PLASMA. P. S. Zyryanov and E. G. Skrotskaya (Urals Polytechnic Inst., Sverdlovsk). Fiz. Tverdogo Tela 2, 1316-20(1960) June. (In Russian)

The importance of nonlinear effects in ion and electron-ion plasma is evaluated for the case of acoustic vibrations. The length of the free Debye phonon trajectories within a metal plasma model is calculated, and the phonon thermal conductivity and relaxation time are evaluated. (R.V.J.)

24724

ON THE DEPENDENCE OF PHOTOCONDUCTIVITY AND LUMINESCENCE INTENSITY OF ANTRACENE CRYSTALS ON THE WAVE LENGTH OF EXCITING LIGHT. V. V. Eremenko and V. S. Medvedev (Kiev Inst. of Physics, Academy of Sciences, Ukrainian SSR). Fiz. Tverdogo Tela 2, 1572-5(1960) July. (In Russian)

The spectral dependence of anthracene monocrystal photoconductivity is based on exciton or free current carrier diffusion to the surface. An analysis was carried out within the framework of an hypothesis band on the special role played by the crystal surface, without considering other causes of quantum yield oscillations. Luminescence and photoconductivity were measured simultaneously in the same crystal. Calculations of wave displacement in relation to luminescence yield and photocurrent magnitude showed very close values. The coincidence of the diffusion displacement of excitons and free current carriers is very improbable; therefore, the spectral dependence of molecular crystal photoconductivity is considered to be due to the diffusion of excitons only. (R.V.J.)

24725

ON THE CONDITIONS OF THE ORIGIN OF γ-CONDUCTIVITY IN CdS SINGLE CRYSTALS. I. D. Konozenko, V. I. Ust'yanov, and A. P. Galushka (Kiev Inst. of Physics, Academy of Sciences, Ukraninian, SSR). Fiz. Tverdogo Tela 2, 1584-91(1960) July. (In Russian)

Gamma conductivity in CdS monocrystals is related to small, local trapping centers ($\Delta E = 0.08$ to 0.14 ev). Without the small traps the γ radiation induces little conductivity ($\Delta 1 \geq 10^{-13}$ a). It is postulated that compton electrons produced by γ scattering excite the current carriers. In the presence of small traps, the excitons decay at negatively charged centers with subsequent transitions of electrons into a conductance zone. (tr-auth)

24726

INFLUENCE OF ELECTRIC FIELD ON THE SCINTILLATION PROCESS IN CsJ (Tl). I. I. Lomonosov and Yu. A. Nemilov. Fiz. Tverdogo Tela 2, 1629-31(1960) July. (In Russian)

Two energy transmitting mechanisms, the exciton and electron vacancy, are possible in alkali halide phosphors. The influence of an electric field on the intensity of luminescence was studied. The crystal was excited by Y^{91} (β particles) and Pu^{239} (α particles) sources. The spectra were measured with a 128 channel analyzer. The total electron activated luminescence (fluorescence and phosphorescence) is reduced by the application of an electric field. The pulse amplitude spectra measured at identical intervals of time, with and without electric field, coincide; this indicates that separate pulse amplitudes are not affected by the field. The electric field does not influence the intensity of luminescence during ultraviolet excitation at 200 to 330 μ, and neither the total luminescence nor the pulse amplitude was affected by the electric field during α activation. The experiments confirm the hypothesis of an exciton mechanism of energy transmission. Concerning the weakening of fluorescence, it is assumed that a vacancy mechanism is responsible for the observed phenomenon. (R.V.J.)

24727

RESULTS OF LOW TEMPERATURE RESEARCH. XXX. THE VAPOR PRESSURE DIFFERENCE OF $C^{12}H_4$ AND $C^{13}H_4$ BETWEEN THE MELTING AND BOILING POINTS. K. Clusius, F. Endtinger, and K. Schleich (Universität, Zürich). Helv. Chim. Acta 43, 1267-74(1960). (In German)

Three widely different results on the vapor pressure differences of $C^{12}H_4/C^{13}H_4$ were reported. New measurements were carried out in which the vapor pressure of ordinary methane (1.08% $C^{13}H_4$) and heavy methane (99.05% $C^{13}H_4$) were directly compared with each other. By a slight extrapolation the relationship $C^{12}H_4/C^{13}H_4$: $\log (\underline{p}_L/\underline{p}_S) = 72.447/T^2 - 0.900/T + 3.547 \times 10^{-3}$ was obtained for the pure isotopic gases. The values obtained by Johns at Harwell were ratified. The essential property variations for the two methanes are given. The $C^{12}H_4/C^{13}H_4$ methanes have only a half percentage of the vapor pressure variation of the carbon oxides $C^{12}O^{16}/C^{13}O^{16}$. On this basis methane is less suitable than carbon monoxide for the enrichment of C^{13} by rectification. (tr-auth)

24728

A PULSED PLASMA MECHANISM FOR PROPULSION IN SPACE. P. M. Mostov, J. L. Neuringer, and D. S. Rigney (Republic Aviation Corp., Farmingdale, N. Y.). IRE Natl. Conv. Record 8, 15p.(1960).

The slug model of a plasma accelerator is formulated and analyzed, incorporating a resistive gradient, R_1. The assumptions upon which the model is based are discussed. Various efficiency measures describing the system performance are defined, and the advantages of each are stated. It is proved that operating the plasma accelerator at the highest possible discharge repetition rate minimizes the accelerator system weight and maximizes the performance. Solutions valid for small times are derived, both by series expansion techniques and by an iterative technique based on the method of variation of parameters. The advantages of each type of formula are discussed. Both types of formula afford an accurate description of the initial system behavior. The WKBJ method is used to prove that the inductive energy in the system asymptotically drops to zero, despite the monotonically increasing system inductance. Curves displaying the results of a wide-range parametric study made on an analog computer are presented. Multistaging of a plasma accelerator is discussed and is shown to increase the efficiency of energy utilization. (auth)

24729

BOMBARDMENT CONDUCTIVITY IN SYNTHETIC ZINC SULPHIDE CRYSTALS. G. F. Alfrey and K. N. R. Taylor (Univ. of Birmingham, Eng.). J. Electronics and Control (1), 8, 301-4(1960) Apr. (In English)

Bombardment conductivity pulses were observed in crystalline zinc sulfide due to irradiation with 5.3 Mev α particles. The counting rate and maximum pulse amplitude were examined as a function of the applied voltage. The results are interpreted in terms of an exhaustion barrier at the negative electrode and the properties of this barrier were determined. (auth)

24730

DETERMINATION OF THE DATE OF EXPLOSIONS OF NUCLEAR BOMBS BY ANALYSIS OF THE RADIOACTIVE DECAY OF THE FISSION PRODUCTS COLLECTED ON A FILTER. A. Cigna and A. Malvicini (Comitato Nazionale per le Ricerche Nucleari, Ispra, Italy). Minerva nucleare 4, 162-9(1960) June. (In Italian)

The possibility of dating nuclear explosions by examining the fall-out is discussed. A method based on the study of the decay curve of the examined sample is described. The dates of 10 explosions in various parts of the world during 1958 were determined by this method. The application of the method is thus illustrated. The error of the described method of dating is discussed; this was found to be some few days at the most. (auth)

24731

AN α-RAY SOURCE AND ITS DOSIMETRY. Ruth F. Itzhaki (Chester Beatty Research Inst., London). Phys in Med. Biol. 5, 61-72(1960) July.

An α-ray source was constructed for irradiation of liquids and of solid films. The dosimetry of liquids was carried out by an actinometric method and of solids by a modification of this method. The radial variation of dose over a circular specimen of film was measured by a radiographic method, and the results agreed satisfactorily with values calculated from theoretical considerations. The axial variation of dose in a film was also found by the modified actinometric method. (auth)

24732

THERMODYNAMIC POTENTIALS FOR SYSTEMS AT NEGATIVE ABSOLUTE TEMPERATURES. Charles E. Hecht (Univ. of Chicago). Phys. Rev. 119, 1443-4(1960) Sept. 1.

It is shown on purely phenomenological grounds that for systems in equilibrium at negative absolute temperatures all the usual thermodynamic potentials, in particular the energy, attain a maximum value instead of a minimum value. (auth)

24733

PHOTOEFFECT FROM THE L SHELL. R. H. Pratt (Stanford Univ., Calif.). Phys. Rev. 119, 1619-26(1960) Sept. 1.

The differential cross section for photoeffect from an atomic shell is shown to be almost independent of principal quantum number, apart from normalization, for energies well above threshold. The high-energy limits of the cross sections for the three L subshells are calculated exactly with methods previously applied to the K shell, and extrapolations are made to cover the entire high-energy region. A procedure is indicated to account for the effects of electron screening. It is found that the contribution from p subshells is not negligible in heavy elements. Agreement with experiment is good. (auth)

24734

DAMPING OF A TORSIONALLY OSCILLATING CYLINDER IN LIQUID HELIUM AT VARIOUS TEMPERATURES AND DENSITIES. Benjamin Welber (National Aeronautics and Space Administration, Cleveland). Phys. Rev. 119, 1816-22(1960) Sept. 15.

A method is described for measuring the product of the viscosity and the density of liquid helium by determining the energy dissipation of a piezoelectric cylinder of quartz oscillating in a torsional mode. Data are reported for liquid helium under its own vapor pressure as well as at higher densities. (auth)

24735

STATISTICAL MECHANICS OF LIQUID He^4. Ryoichi Kikuchi, Harry H. Denman, and Charles L. Schreiber (Wayne State Univ., Detroit). Phys. Rev. 119, 1823-31 (1960) Sept. 15.

The partition function proposed by Feynman for liquid He^4, based on his path integral method, is evaluated for a simple cubic lattice considering long-range permutations as well as nearest-neighbor permutations. The result indicates a second-order phase transition at the λ point. The marked improvements over the previous treatment are that the specific heat behaves as T^3 near absolute zero; the specific heat peak is more pronounced at the λ point; and when triangles are added as possible finite polygons above T_λ, the specific heat just above T_λ increases over the previous result showing an improvement. Equating the theoretical λ point with the experimental, a value for the effective mass of a helium atom about 1.6 times the normal mass is obtained. (auth)

24736

SPIN RELAXATION OF F-CENTER ELECTRONS. W. E. Blumberg (Univ. of California, Berkeley). Phys. Rev. 119, 1842-50(1960) Sept. 15.

Several possible mechanisms leading to spin transitions in the electron-nuclear spin system of an F-center electron and its neighboring nuclei were examined. Calculations show that the most probable transition is one in which the electron spin changes but the nuclear spin does not change and which results from the second-order perturbation of the spin-orbit coupling of the electron due to lattice vibrations. The spin-lattice relaxation time of the F-center electrons in NaCl at 300°K was measured at 70, 2950, and 8300 gauss. The relaxation time was 2×10^{-6} second, independent of the magnetic field, this was in approximate agreement with the theory. (auth)

24737

MEASUREMENT OF F-CENTER CONCENTRATION AND RELAXATION TIME BY MICROWAVE FARADAY ROTATION. D. T. Teaney, W. E. Blumberg, and A. M. Portis (Univ. of California, Berkeley). Phys. Rev. 119, 1851-3 (1960) Sept. 15.

The use of a bimodal cavity for the observation of electron spin resonance is described. The two samples of NaCl containing F centers used by Blumberg were investigated by electron spin resonance. Their F-center concentrations were found to be 4.4×10^{17} and 2.3×10^{18} electrons/cm^3, respectively. The spin-lattice relaxation time at room temperature of the F-center electrons was found to be 1.7 microseconds. (auth)

24738

FINE STRUCTURE OF SHORT-LIVED STATES OF HYDROGEN BY A MICROWAVE-OPTICAL METHOD. [PART] I. W. E. Lamb, Jr. and T. M. Sanders, Jr. (Stanford Univ., Calif.). Phys. Rev. 119, 1901-14(1960) Sept. 15.

A radio-frequency determination of the fine structure of excited states of hydrogen atoms is described. In this method the atoms are excited by electron bombardment so that they emit radiation. Transitions among the fine structure levels are induced by a radio-frequency electric field and are detected by the consequent change in intensity of the emitted radiation. A detailed theory of the method is presented and the experimental apparatus is discussed and described. Some preliminary results for the n = 3 level of deuterium are $\Delta E - S = 2934.5 \pm 10$ Mc/sec, $S = 316.3 \pm 10$ Mc/sec, where ΔE is the separation $3^2P_{1/2} - 3^2P_{3/2}$, and S the separation $3^2S_{1/2} - 3^2P_{1/2}$. These results are in agreement with predictions of quantum electrodynamics. (auth)

24739

FINE STRUCTURE OF SHORT-LIVED STATES OF HYDROGEN BY A MICROWAVE-OPTICAL METHOD. [PART] II. L. R. Wilcox and W. E. Lamb, Jr. (Stanford Univ., Calif.). Phys. Rev. 119, 1915-33(1960) Sept. 15.

Fine-structure separations were determined in excited states n = 3 and 4 of deuterium. Experimental and theoretical studies were made of the effects of environmental electric fields on the relative intensities of various resonances in order to obtain information about possible Stark shifts of the fine-structure levels. The density matrix method, used in Part I for two levels, was extended to N levels and worked out more explicitly for the case of three levels. The splitting $3^2S_{1/2} - 3^2P_{1/2}$ was found to be 315.30 ± 0.08 Mc/sec compared with a calculated value of 315.34 Mc/sec. Less precise measurements were made for other separations, which were also in good agreement with theory. (auth)

24740

COLLISIONS OF ELECTRONS WITH HYDROGEN ATOMS. V. EXCITATION OF METASTABLE 2S HYDROGEN ATOMS. R. F. Stebbings, Wade L. Fite, David G. Hummer, and R. T. Brackmann (General Atomics Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 119, 1939-45(1960). Sept. 15.

Ground-state hydrogen atoms produced by thermal dissociation in a tungsten furnace were excited by collision with electrons having energies up to 600 ev. Those atoms that were excited to the metastable 2S state were subsequently quenched in an electrostatic field, and the resulting Lyman-alpha radiation was detected with an iodine-vapor-filled photon counter. In order to assign absolute cross-section values to the excitation function obtained in this way, the ratio of the 2S to the 2P excitation cross sections was determined. From previously obtained knowledge of the cross section for excitation to the 2P state, the absolute 2S cross section was evaluated. Agreement with the Born approximation was observed at high energies. The angular distribution of the scattered 2S atoms was also investigated for electron energies up to 600 ev. (auth)

24741

SELF-DIFFUSION COEFFICIENT AND NUCLEAR SUSCEPTIBILITY OF LIQUID He^3. A. C. Anderson, H. R. Hart, Jr., and J. C. Wheatley (Univ. of Illinois, Urbana). Phys. Rev. Letters 5, 133-5(1960) Aug. 15.

The self-diffusion of the magnetization was measured at pressures of 5 to 9 cm Hg in pure liquid He^3 and in liquid He^3 containing 1.2% He^4 at 0.032 to 0.15°K. The nuclear susceptibility relative to its value at the He^4 bath temperature was measured at similar pressures in pure He^3 from 0.031 to 1.3°K, and in He^3 containing 1.2% He^4 at 0.032 to 1.3°K. No evidence was found for a transition of the liquid into any kind of cooperative state. Graphical representations of the results are included. Results indicate that the addition of 1.2% He^4 does not change the values for either case within the limits of experimental error. (B.O.G.)

24742

GENERALIZED BARDEEN-COOPER-SCHRIEFFER STATES AND ALIGNED ORBITAL ANGULAR MOMENTUM IN THE PROPOSED LOW-TEMPERATURE PHASE OF LIQUID He^3. P. W. Anderson (Bell Telephone Labs., Murray Hill, N. J.) and P. Morel. Phys. Rev. Letters 5, 136-8(1960) Aug. 15.

An investigation was conducted within the limits of the Bardeen-Cooper-Schrieffer (BCS) theory of the properties of the l = 1, 2, 3, . . . states of condensed fermions. The study is confined to states only of zero-total momentum. The results indicated that the most unusual properties were connected with the angular momentum. Less spectacular were the superfluidity or superconductivity properties. Unlike the case for l = 0, the states for all higher l's are sensitive to impurity scattering effects. (B.O.G.)

24743

THERMAL CONDUCTIVITY OF ISOTOPIC MIXTURES OF SOLID HELIUM. F. W. Sheard and J. M. Ziman (Univ. of Cambridge, Eng.). Phys. Rev. Letters 5, 138(1960) Aug. 15.

Comments are given concerning the work carried out by Walker and Fairbank on the thermal conductivity of He^4 containing small amounts of He^3 and its comparison to the Klemens theory and results calculated from the variational treatment of Berman et al. It is pointed out that the Klemens formula is in error by a factor of 55. An increase of 55 in the Walker and Fairbank's theoretical curve causes this curve to rest almost in the middle of the observed data. It is concluded that there seems to be no need to invoke lines of He^3 atoms to explain the observations made during the investigations. (B.O.G.)

24744

THERMAL CONDUCTIVITY OF SOLID He^3. E. J. Walker and Henry A. Fairbank (Yale Univ., New Haven). Phys. Rev. Letters 5, 139-40(1960) Aug. 15.

Measurements are reported of the thermal conductivity above 1.1°K for the two solid phases of He^3. The lower-density lower-pressure phase (α) is body-centered cubic;

the higher-density higher-pressure phase (β) has a hexagonal close-packed structure as does solid He^4. The thermal conductivity in the β phase is similar to that of solid He^4 and is in reasonable agreement with that expected from Peierls' theory for umklapp scattering. The thermal conductivity as a function of reciprocal temperature for the density is given, which clearly indicates that there is a discontinuity and a change in the slope of the curve that occurs at the α-β phase transition. In the α phase a change in the slope of the curve occurs at 1.3 to 1.6°K. The results in the β phase are consistent with the assumption that the thermal resistance of the crystal arises principally from phonon-phonon umklapp interaction. Several mechanisms are considered to explain the behavior in the α phase. (B.O.G.)

24745

AGE MEASUREMENT BY RADIOCARBON. M. Lorthioir [(Manufacture Belge de Lampes et de Materiel Electronique, Brussels)]. Rev. M.B.L.E. 3, 156-81(1960) Aug. (In French)

After a brief review of the formation of radiocarbon in the atmosphere and of its principal physical characteristics, the principle of the method for age determination with C^{14} and the manner in which it is verified are described. Different types of detectors utilized for the measurement of radiocarbon are considered, and their performances in the dating of samples are compared. A critical examination is then made of the precision of the method and of the different sources of error. By some typical examples, both the scientific and historic interest in the determination of the age of geological and archeological samples are shown. (tr-auth)

24746

MEASUREMENT OF ELECTRON EMISSION IN A METAL SURFACE MICROSCOPE. Karl-Heinz Gaukler (Universität, Tübingen, Ger.). Z. Metallk. 51, 463-6(1960). Aug. (In German)

The electron intensity caused in an emission microscope by an ion bombardment from the side in order to visualize metal surfaces was determined for 18 metals and for different discharge gases. (auth)

24747

PRIMARY RARE GASES IN SOME STONE METEORITES. J. Zähringer and W. Gentner (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Naturforsch. 15a, 600-2 (1960) July. (In German)

In the two chondrites Kapoeta and Abee, outstanding rare gas content was found. From the amount and isotopic composition, it is concluded that primordial rare gases were included in these meteorites. Kapoeta contains all rare gases in excess, whereas Abee has mainly the heavier rare gases as primordial component. The Ne^{20}/Ne^{22} and Ar^{36}/Ar^{38} ratios show large deviations from atmospheric neon and argon. No such large deviations could be found for krypton and xenon. (auth)

24748

DETERMINATION OF THE SIZE OF POLONIUM RADIOCOLLOIDAL PARTICLES. R. Lindner, H. Reinhardt, and J. O. Liljenzin (Technische Hochschule, Göteborg). Z. Naturforsch. 15a, 643-4(1960) July. (In German)

The size of radiocolloidal particles is determined from a measurement of the diffusion coefficients. The capillary method was tested for the measurement of self-diffusion. By investigation of the dependence of the calculated diffusion coefficient on the capillary diameter and diffusion time, the reliability of the method was proved. The results obtained at various pH values are tabulated. (J.S.R.)

24749

POLARIZATION OF Sc^{46} IN IRON. A. V. Kogan, V. D. Kul'kov, L. P. Nikitin, N. M. Reinov, I. A. Sokolov, and M. F. Stel'makh (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 39, 47-52(1960) July.

The γ-irradiation of polarized nuclei of Sc^{46} in an alloy with pure iron was measured at (1.5 to 3) $\times 10^{-2}$ °K temperature. The effect observed indicates that the introduction of scandium into the ferromagnetic substance leads to the appearance of an effective magnetic field H_{eff} of the order of 10^5 gauss which acts on the nucleus. In the case of cobalt introduced into iron, the effective field is (3 to 4) $\times 10^5$ gauss. (auth)

24750

ELECTRON LEVELS OF ATOMS OF SUPER-HEAVY ELEMENTS. V. V. Voronkov and N. N. Kolesnikov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 39, 189-91 (1960) July. (In Russian)

The behavior of electron ns-levels in the field of finite size nuclei with $Z > 137$ is considered near $\epsilon \sim -m$ and $\epsilon \sim +m$ on the basis of the Dirac equation. The critical values $Z = Z_{cr}$ are found and the existence of quasi-levels for $\epsilon < -m$ and $Z > Z_{cr}$ is demonstrated, and an interpretation is suggested. (auth)

24751

A GRAPHICAL TECHNIQUE FOR COMPUTATION OF KINETIC QUANTITIES. O. V. Konstantinov and V. I. Perel (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 39, 197-208(1960) July. (In Russian)

A graphical technique was developed for computing the one-electron density matrix. A kinetic equation was deduced from the quantum theory which takes into account the inhomogeneity of the external electric field and the self-consistent electron field. (auth)

24752

ON THE SHAPE OF LIQUID HELIUM II ELEMENTARY EXCITATION SPECTRA. L. P. Pitaevskiĭ (Inst. of Geomagnetism, Ionosphere and Wave Propagation, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 39, 216-17(1960) July. (In Russian)

Data published on the excitation spectra of liquid helium II at $\Sigma = 2\Delta = 17.3$°K show that the function $\Sigma(p)$ has a second negative derivative (i.e., that the spectrum bends in the investigated region). This indicates, according to the author, a second maximum in the $\epsilon(p)$ function. A different concept of the phenomenon is suggested which postulates that the energy of liquid helium II cannot rise above $\epsilon = 2\Delta$ because the elementary excitation at energies $\epsilon \geq 2\Delta$ breaks up into two excitations with energy $\epsilon = \Delta$. At $\epsilon = 2\Delta$ the $\epsilon(p)$ curve reaches a maximum and breaks, therefore that point is the end of the spectrum. A visual concept of the spectral line is included. (R.V.J.)

24753

ELECTRONS AND PHONONS. The Theory of Transport Phenomena in Solids. J. M. Ziman. The International Series of Monographs on Physics. Oxford, Clarendon Press, 1960. 564p.

The transport properties of solids (their capacity to conduct heat and electricity) are treated. Since these properties are due almost entirely to the vibrations of the crystal lattice and to the motion of electrons through the crystal, together with the strong interactions between these types of excitation, the subject has a natural unity. No attempt is made to discuss ionic conductivity, which is more appropriately part of the topic "Defects in Solids." In many aspects the facts are well known or easily accessible; the problem is to explain them. Research on the solid state has shifted away from general explanations to a study of the particular properties of particular specimens and their interpretation in terms of electronic structure, chemical purity, crystal structure, crystal perfection, etc. These chemical and structural effects are emphasized, and it is shown how they may be calculated and used as a tool for further investigation, without discussing individual metals or alloys. The mathematical concepts of the physical theory are developed on the level normally taught to the graduate student doing experimental research in solid-state physics. (B.O.G.)

Astrophysics and Cosmology

24754 NP-tr-341
INTERSTELLAR GAS DYNAMICS. (Mezhzvezdnata Gazodinamika). S. A. Kaplan. Translated from a publication of the State Publishing House of Literature in Physics and Mathematics, Moscow, 1958. 212p. OTS.

The basic methods of interstellar gas dynamics, considered as a subdivision of hydrodynamics and gasodynamics with specific applications, are set forth. Distribution, motion, turbulence, physical state, motion discontinuities, and equations of motion of interstellar gas are discussed. (W.D.M.)

24755
THE ACCRETION OF COSMIC MATTER TO THE EARTH. M. Pettersson. Endeavour 19, 142-6(1960) July.

The results of recent investigations of the accretion of cosmic matter to earth, made by analyzing deep-sea cores and air samples taken at observations remote from the contaminating effects of industrial activity, are reviewed. For the study of deep-sea deposits, a piston core-sampler was used to raise almost undisturbed cores 15m in length. All the investigated samples showed the presence of cosmic spherules in amounts from 100 to 2000 per kg. The variation in numbers depended both on geographical location and depth below the sediment surface. In general, the number of spherules was greatest in the more recent sediments. Calculations based on average concentrations in the most recent sediments indicated a fall of 1000 to 5000 tons of spherules annually. The rate of accretion of meteoric dust was calculated from the results obtained by passing large volumes of air through filters at two high-altitude observatories in Hawaii. Results indicated that the annual rate of accretion of cosmic dust is 5 million tons. (M.C.G.)

24756
FLUID MOTIONS IN A SPHERE. IV. THERMAL INSTABILITY OF A ROTATING FLUID SPHERE HEATED WITHIN UNDER A UNIFORM MAGNETIC FIELD. Tomikazu Namikawa (Osaka City Univ.). J. Geomagnet. Geoelec. 11, 111-24(1960). (In English)

The conditions for which a fluid sphere heated within and subject to the simultaneous action of a uniform magnetic field and rotation can become unstable via a marginal state of purely oscillatory motion are studied. Contrary to previous results, over-stability occurs both under astrophysical and terrestrial conditions. (auth)

Cosmic Radiation

24757 DRTE-Publ.-1025(p.51-8)
Alaska. Univ., College. Geophysical Inst.
OBSERVATIONS OF LOW ENERGY COSMIC RAYS OF SOLAR ORIGIN. G. C. Reid and H. Leinbach.

The ionospheric absorption of galactic radio waves in high altitudes occasionally occurs for several days' duration. The long duration of these events, interpreted as due to protons emitted by the sun at the time of a major solar flare, is discussed. Estimates of the energy of the protons and of their number density in interplanetary space are made. (C.J.G.)

24758 DRTE-Publ.-1025(p.59-66)
Canada. Defence Research Telecommunications Establishment, Ottawa.
THE OBSERVATIONAL EVIDENCE FOR TWO DISTINCT TYPES OF FLARE-EJECTED SOLAR PARTICLES. J. L. McAlpine, A. G. Matthews, and T. R. Hartz.

The nature of the flare-ejected solar particles required to produce various terrestrial disturbances (ionospheric absorption of radio waves at high geomatic latitudes and magnetic storms) was studied. These two types of terrestrial disturbances were observed and evidence is presented for the occurrence of two distinct types of flare-ejected solar particles. (C.J.G.)

24759 DRTE-Publ.-1025(p.93-101)
Canada. Defence Research Telecommunications Establishment, Ottawa.
DIRECT OBSERVATIONS OF CHARGED PARTICLES TRAPPED BY THE EARTH'S MAGNETIC FIELD. W. J. Heikkila.

A review of the observations made by rockets and satellites on the Van Allen radiation belts is presented. The Argus experiment is discussed. (C.J.G.)

24760 DRTE-Publ.-1025(p.303-10)
Iowa. State Univ., Iowa City.
SATELLITE OBSERVATIONS OF SOLAR COSMIC RAYS AND OTHER LOW ALTITUDE CHARGED PARTICLE INTENSITY VARIATIONS. P. Rothwell.

Large increases in the intensity of charged particles outside the Van Allen belts were detected by Explorer IV at high magnetic latitudes (event B) and at low satellite altitudes (250 to 600 km) (event A). Type B events are interpreted as being due to solar protons with energies up to a few hundred Mev. Type A events are interpreted as being due to electrons with energies of tens or hundreds of kilovolts scattered from the Van Allen belt. (C.J.G.)

24761 DRTE-Publ.-1025(p.361-71)
Alaska. Univ., College. Geophysical Inst.
SPECULATIONS ON THE CONNECTION BETWEEN THE VAN ALLEN RADIATION AND THE AURORA. G. C. Reid and M. H. Rees.

The effects of particle streams of solar origin on the trapped Van Allen particles surrounding the earth are examined. A mechanism is proposed to explain the nocturnal latitude drift of the hydrogen emission associated with aurora. It is shown that if the extent of this latitude drift is used to define an effective 'auroral zone' at any time, then this zone must move toward the equator and expand under highly disturbed conditions. (auth)

24762
IONOSPHERIC STRUCTURE ABOVE FORT CHURCHILL, CANADA, FROM FARADAY ROTATION MEASUREMENTS. Raymond E. Prenatt (Aberdeen Proving Ground, Md.). ARS (Am. Rocket Soc.) J. 30, 763-5(1960) Aug.

Integrated electron content in the ionosphere above Fort Churchill, Manitoba, Canada, was computed for a number of sounding rocket firings during the International Geophysical Year. The method used involves the determination of the Faraday rotation of the 76.06 Mc Doppler Velocity And Position (DOVAP) tracking signal transmitted from the rocket. The expression relating Faraday rotation to integrated electron content is given, and the technique for measuring Faraday rotation using DOVAP spin records is described. Integrated electron content for two of the flights evaluated to date is presented with particular reference to some of the more interesting or unexpected results obtained. (auth)

24763
THE SUDDEN INCREASE IN COSMIC RAY INTENSITY OF MAY 4, 1960. D. C. Rose (National Research Council of Canada, Ottawa). Can. J. Phys. 38, 1224-7(1960) Sept.

Records from four Canadian stations showing a sudden increase in cosmic ray intensity on May 4, 1960, were analyzed and the intensity variations determined. Curves representing the intensity changes of nucleon and meson components are given for Resolute, Churchill, Sulphur Mountain, and Ottawa. (M.C.G.)

24764
INVESTIGATION OF ELECTRON AVALANCHES IN AIR USING A CLOUD CHAMBER. K. R. Allen and K. Phillips (Associated Electrical Industries, Ltd., Manchester, Eng.). J. Electronics and Control (1) 8, 273-88(1960) Apr. (In English)

The growth of electron avalanches was studied in a homogeneous field electrode configuration in air using an expansion cloud chamber. The effect of such parameters as the expansion ratio, type of vapor, and irradiation of the cathode on the avalanche growth was studied. The velocity of the avalanche growth was measured in air at pressures of 400, 580, and 680 mm Hg for values of X/p from 30 to 40 volts/cm/mm. The measurements of Raether at X/p of 41 volts/cm/mm (pressure 270 mm Hg) tend to agree with the present experimental values extrapolated. Both the results of Nielsen and Bradbury and Townsend and Tizard appear to be higher by about 12%. Estimates were made of the thermal energy of the electrons from both the avalanche width and velocity, and large discrepancies were found. (auth)

24765
PROPAGATION OF LOW ENERGY COSMIC RAY PARTICLES ASSOCIATED WITH SOLAR FLARES. Kunitomo Sakurai (Kyoto Univ.). J. Geomagnet. Geoelec. 11, 152-64 (1960). (In English)

Low-energy cosmic rays are produced in solar flares and propagate into interplanetary space. The features of the propagation mechanism of these cosmic rays were examined, taking into account the results deduced from the theory of geomagnetic effect. The features of their incidence to the earth had impact-zone effects, G.M.T. effects, and seasonal variations. The relations between these low-energy cosmic-ray events and solar and terrestrial phenomena were examined in view of the observed data. Flares and type IV outbursts taking place on the western side of the sun seem to correlate these cosmic-ray events much better. The propagation mechanism of these low-energy cosmic rays into interplanetary space and the properties of magnetic clouds in that space are discussed. (auth)

Criticality Studies

24766 HW-62117
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DESIGN CRITERIA FOR PRP—CRITICAL FACILITY. PROJECT CAH-842. G. L. O'Neill and H. K. Nelson. Dec. 18, 1959. 93p. OTS.

The PRP Critical Facility is an experimental reactor for use in determinations of basic nuclear constants of heterogeneous reactors recycling Pu and for use in exponential and criticality studies at power levels up to 100 watts and neutron fluxes of about 10^9 nv. Both light- and heavy-water moderators will be used. Design criteria are established for the building, fuel-handling system, reactor assembly, moderator systems, control mechanisms, and instrumentation. Operating procedure is detailed. (W.D.M.)

24767 TID-6392
Case Inst. of Tech., Cleveland.
SOLID STATE PHYSICS PROGRAM. CALCULATIONS ON THE GROUP THEORY AND BAND STRUCTURE OF CADMIUM SULFIDE. Technical Report No. 9. Donald A. Cohen. June 1960. 94p. Contract AT(11-1)-623. OTS.

The group theory of the wurtzite structure is discussed and applied to determine symmetrized combinations of plane waves (scpw's) which transform according to the irreducible representations of the group of the wave vector. A general expression for the matrix elements of the Hamiltonian between the scpw's is developed. The crystal potential is constructed from empirical, orthonormal Slater atomic wave functions. It is assumed to be a superposition of atomic potentials. The Fourier coefficients of the potential are calculated for the purpose of determining the band structure by the Phillips and Kleinman "effective potential" method to be accomplished at a later date. The escalator method of solving secular determinants is discussed and extended for determinants of Hermitian matrices. (auth)

Elementary Particles and Radiations

24768 AE-35
Aktiebolaget Atomenergi, Stockholm.
THE MULTIGROUP NEUTRON DIFFUSION EQUATIONS/1 SPACE DIMENSION. Sven Linde. Mar. 1960. 42p.

A description is given of a program for the Ferranti-Mercury computer which solves the one-dimensional multigroup diffusion equations in plane, cylindrical, or spherical geometry, and also approximates automatically a two-dimensional solution by separating the space variables. The method of calculation is outlined and the preparation of data for two-group problems is described. The spatial separation of two-dimensional equations is considered. Details of the numerical methods are given and three sample problems are solved. Punching and operating instructions are given. (auth)

24769 AFOSR-TN-60-567
Washington Univ., St. Louis.
STRUCTURE OF WEAK INTERACTIONS. Technical Report No. 34. Joseph F. Dreitlein and H. Primakoff. Aug. 1960. 137p. Project No. 37504. Contract AF18(603)-108.

The general structure of weak dynamics if studied from an S-operator formalism with a minimum number of assumptions, and the consequences of the formalism are applied to the study of the weak interactions of particles of strangeness zero. In order to investigate the weak dynamics involved in nuclear β decay, the possibility of a conserved nucleon current as the element coupled to the lepton current is discussed, and the consequences of such a current are sought in the forbidden nuclear beta transitions. The problem of μ decay from the Coulomb-bound lowest Bohr orbit is subjected to a theoretical analysis. Of particular concern are the μ-decay rate and the influence of a Coulomb field on a charged boson coupling the weak currents. The possibility of "very weak" interactions is entertained and two models of such interactions are investigated: the model of multiple weak interactions suggested by second-order perturbation theory and a purely phenomenological model allowing the radiative conversion of μ to e. (auth)

24770 AFOSR-TN-60-769
Stanford Univ., Calif. Inst. of Theoretical Physics.
THE DECAY $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$ AND THE $\Sigma^0 - \Lambda^0$ RELATIVE PARITY. Technical Note No. 22. Nina Byers. July 1960. 13p. Project No. 9750-37500. Contract AF49(638)-388.

The analysis of Kroll and Wada is applied to the process $\Sigma^0 \rightarrow (\Lambda^0 + \gamma) \rightarrow \Lambda^0 + e^+ + e^-$, and it is found that the photons which undergo internal conversion tend to be transverse with electric vector normal to the plane of the electron–positron pair. From this it follows that if the Σ^0 and Λ^0 have equal spin, the internal conversion of the photons in decays of polarized Σ^0's offers a means of measuring the $\Sigma^0 - \Lambda^0$ relative parity. Measurement of the Σ^0 spin and $\Sigma^0 - \Lambda^0$ relative parity is discussed. (W.D.M.)

24771 AFOSR-TN-60-937
Uppsala Univ. Inst. of Physics.
ANTIPROTON ANNIHILATIONS IN COMPLEX NUCLEI. Technical Note No. 1. A. G. Ekspong, A. Frisk, S. Nilsson, and B. E. Ronne. [1960]. 83p. Contract AF61(052)-13.

Three hundred and fifty-six antiproton annihilations in nuclear emulsion were investigated. The average pion multiplicity and total energy in the primary process were found to be: at rest $(N'_\pi) = 4.68 \pm 0.12$, $(E''_\pi) = 391 \pm 10$ Mev; in flight $(N'_\pi) = 5.11 \pm 0.12$, $(E'_\pi) = 390 \pm 9$ Mev at $(T_{\bar{p}}) = 166$ Mev. The results for $K\bar{K}$–production were: percentage at $K\bar{K}$–pairs $(N'_{K\bar{K}}) = 3 \pm 2\%$; average energy $(E_{K\bar{K}}) = 33 \pm 22$ Mev/star. The annihilation process in flight was carefully analyzed. The experimental pion multiplicity and energy distributions were compared with the predictions of different theories. The ratio of stars with an odd/even number of charged pions was 0.73 ± 0.09 (at rest), which indicates that the probability for antiproton annihilation on neutrons is less than one would expect theoretically. The world data on antiproton annihilations are discussed. (auth)

24772 DRTE-Publ.-1025(p.197-214)
Bell Telephone Labs., Inc., Murray Hill, N. J.
CRITICAL CONSIDERATIONS IN THE ANALYSIS AND BEHAVIOUR OF WAVE PHENOMENA IN ELECTRON BEAMS. PART I: CRITICAL POINTS IN THE THEORY OF ELECTRON BEAM DEVICES. J. R. Pierce.

Electron beam calculations were made for multivelocity smoothed-out electron flow, taking into account the noise introduced by graininess of the flow. The multistream approach and an approach in which the particle velocity is regarded as a coordinate rather than a variable were applied. Instabilities of electron beams in the presence of ions and at high currents were analyzed. The occurrence and types of growing waves are discussed. (C.J.G.)

24773 DRTE-Publ.-1025(p.231-41)
Canada. Defence Research Telecommunications Establishment, Ottawa.
RADIATION FROM SPACE CHARGE WAVES IN A STATIC MAGNETIC FIELD. R. E. Barrington and R. E. Pugh.

The calculation of radiation produced by space charge waves in an ionized plasma is considered. An ion stream is considered as the mechanism by which the plasma waves are amplified. The space charge is considered incident upon a step in density. The amplitude of the resulting electromagnetic wave was then calculated by treating the density step as a perturbation in the electron density. The treatment is similar to that of Gould, except that the effect of the earth's magnetic field is taken into account. Considerable whistler noise was found to be produced in regions of rapid charge density variation. (C.J.G.)

24774 SRB-60-2
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
LABORATORY PROPAGATION AND MEASUREMENT OF VISIBLE AND NEAR-INFRARED RADIATION. An Annotated Bibliography. A. A. Beltran, comp. June 13, 1960. 32p.

The laboratory testing of solar-energy devices requires a light source operating in the region from 4000 to 13,000 A at 2800°K. A bibliography is presented which is concerned with sources of radiation within these wavelengths and methods and instrumentation for the measurement of color, temperature, intensity, magnitude, and uniformity of radiation. Sixty-two references with abstracts are given. (W.D.M.)

24775 TID-6280
General Atomic Div., General Dynamics Corp., San Diego, Calif.
B-SPECTRUM CODE OR THERMALIZATION. H. Donald Brown, Jr. and M. S. Nelkin. [195?]. 11p. Project No. 48. Contract AT(04-3)-167. (GAMD-1176). OTS.

An IBM-704 program was prepared for solution of the neutron balance equation in an infinite homogeneous medium. This program is designed for studying the effects of varying the energy transfer kernel on the resultant neutron spectrum. A rapidly iterative procedure is employed. The equation to be solved and the specific input information required by the program in order to compute spectra are explicitly stated. (W.D.M.)

24776 TID-6386
Wisconsin. Univ., Madison and Michigan State Univ., East Lansing.
RADIATIVE DECAY MODES OF THE MUON. R. R. Crittenden, W. D. Walker, and J. Ballam. [1959]. 45p. Contract AT(11-1)-64. OTS.

A 5-in. Freon bubble chamber was used to search for the following positive muon decay modes: $e^+ + \gamma$, $2e^+ + e^-$, $e^+ + \nu^0 + \bar{\nu}^0 + \gamma$, and $2e^+ + \nu^0 + \bar{\nu}^0 + e^-$. A total of 200,000 pictures was taken yielding 3.3×10^5 μ^+ decays. A summary is given of previous experiments on these decay modes and results are discussed with special reference to the intermediate boson scheme of weak four fermion interactions. (W.D.M.)

24777 UCRL-9249
California. Univ., Berkeley. Lawrence Radiation Lab.
THE TWO-PION EXCHANGE CONTRIBUTION TO THE HIGHER PARTIAL WAVES OF NUCLEON-NUCLEON SCATTERING (thesis). Peter Cziffra. June 9, 1960. 78p. Contract W-7405-eng-48. OTS.

By means of the Mandelstam representation, expressions are obtained for the two-pion-exchange contributions to the higher partial waves of N-N scattering. A set of ten invariant amplitudes is selected, of which each member obeys the Mandelstam representation. Dispersion relations are written for the amplitudes in which the discontinuities are absorptive parts for N-$\bar{N}$ scattering. By means of the unitarity condition the absorptive parts are expressed as a partial-wave expansion in terms of the $\pi\pi \rightarrow$ NN partial-wave amplitudes of Frazer and Fulco, except for the contributions of the pole in the π-N system which are treated exactly in order to ensure better convergence of the partial-wave expansion. The N-N transition amplitudes in the angular-momentum representation are expressed in terms of the invariant amplitudes. (auth)

24778

MESON DECAYS OF LIGHT HYPERNUCLEI. Zdenek Korbel and Ladislav Rob (Faculty for Technical and Nuclear Physics, Prague). Českoslov. casopis pro fysiku 9, No. 1, 57-9(1959). (Translated from Referat. Zhur. Fiz. No. 1, 1960, abstract No. 430).

The binding energies of five light hypernuclei produced in the capture of K^- mesons by photoemulsion nuclei were measured. The following results were obtained (the brackets contain the binding energies in Mev): He^5(1.9 ± 0.5); He^4(0.8 ± 0.5); He^7(2.7 ± 0.6); He^3(0.0 ± 0.5); and H^4(1.3 ± 0.4).

24779

PARITY NON-CONSERVATION IN THE NEUTRINO THEORY. Antonin Vaneura. Českoslov. časopis pro fysiku 9, 178-91(1959). (Translated from Referat. Zhur. Fiz. No. 12, 1959, abstract No. 26796).

A survey was made of the results of the latest researches on the properties of symmetry of the Hamiltonian of weak interactions. Particular attention was paid to the Hamiltonian of decay in various neutrino theories and to a comparison of the interaction between the Coulomb and lepton fields in the two-component and ordinary four-component neutrino theories. The interaction between the laws of conservation of parity and the number of leptons was investigated. In conclusion the hypothesis of the universal Fermi interaction was considered in its relation to the two-component neutrino theory. A bibliography of approximately 70 titles is included.

24780

REALIZATION OF A STRONGLY IONIZED PLASMA OWING TO THE COMBINATION OF THE PINCH EFFECT AND OF A "LUNATE" MAGNETIC GEOMETRY. Jean-Paul Watteau (Univ. of California, [Berkeley]). Compt. rend. 251, 532-4(1960) July 25. (In French)

An apparatus is described which permits the obtention of a very hot plasma by two successive discharges. The first discharge operates by the pinch effect; the second exploits the "lunate" geometry (suggested by Grad), which assures a stable confinement of the hot plasma thus created. The first results obtained are described. (tr-auth)

24781

THEORY OF MULTIPLE PARTICLE PRODUCTION AT EXTREMELY HIGH ENERGY. Ziro Koba (Kyoto Univ.) and Shuji Takagi. Fortschr. Physik 7, No. 1, 1-47(1959). (Translated from Referat. Zhur. Fiz. No. 1, 1960, abstract No. 394).

A critical survey is given of experimental and theoretical research on multiple production of particles at energies greater than 100 Bev. The survey consists of three parts. In part I the experimental data pertaining to the elementary process of nuclear collisions at high energies are considered. The specific features of the photoemulsion method are analyzed and information obtained by its use on the characteristics of the elementary act is given. An analogous analysis is made for extensive atmospheric showers. In part II a critical survey of the existing theories and models of multiple production of particles is given; comparison is made of the predictions of each of these with the available experimental material. Finally, part III analyzes the principles of different theories and attempts to establish the relations between them. In particular, the connection between the Landau hydrodynamic theory and the field theory is considered, together with the possibility of obtaining the hydrodynamic picture from the quantum equation. In view of the complications arising owing to quantum fluctuations, the possibility is considered of choosing such quantities, which behave almost classically. The significance of the study of multiple production to the theory of elementary particles is discussed.

24782

EFFECTS OF COLLISIONS ON THE CYCLOTRON RADIATION FROM RELATIVISTIC PARTICLES. Ludwig Oster (Yale Univ., New Haven). Phys. Rev. 119, 1444-56(1960) Sept. 1.

The effects of collisions on the cyclotron radiation from relativistic particles are investigated, supposing a uniform velocity for the particles. For the collision process, it is assumed that the particles start to radiate at a certain time and are abruptly stopped by the collision, after which they start to radiate again with random phase. The probabilities for the occurrence of a certain time interval between two collisions are then assumed to be distributed according to a statistical law. The field equations are derived from the familiar Liénard-Wiechert potentials and Fourier-analyzed. Simple integral representations are found for the combined spectral and angular distribution of the radiation. Under the basic assumption that the particles make many revolutions between two collisions, it is shown that the radiation pattern is that of a series of spectral lines, each having a dispersion profile. The relative intensities of the lines are given by the formula well known from previous work neglecting collisions. For the "slightly relativistic" energy range, $\beta_0 = 0.5$ to 0.9, which is of interest to thermofusion experiments, graphs are given for the actual intensity distribution of the various harmonics as a function of the angle between the observer and the orbital plane. (auth)

24783

MAGNETIC SCATTERING OF NEUTRONS BY EXCHANGE-COUPLED LATTICES. A. W. Sáenz (Naval Research Lab., Washington, D. C.). Phys. Rev. 119, 1542-59(1960) Sept. 1.

The magnetic scattering of slow neutrons of arbitrary initial polarization by an extensive class of magnetically-coupled lattices is treated by a time-dependent operator approach for the case of complete orbital quenching of the magnetic ions. This magnetic scattering is carefully divided into purely magnetic and magneto-vibrational scattering, the types thereof involving, respectively, only zero-phonon processes and solely nonzero-phonon processes; general formulas for these two types of scattering are obtained. These formulas are applied in temperature regions which are sufficiently large (I) or sufficiently small (II) compared with the temperature above which paramagnetism obtains. In region I, for the purely magnetic scattering and under certain invariance requirements on the above magnetic coupling, the energy spectrum of outgoing initially unpolarized neutrons of sufficiently high incident energy is analyzed by a moment method. Thus general formulas are obtained for the energy-integrated effective differential cross section and for the moments of energy transfer. These formulas involve certain spin averages; explicit equations are given for a wide range of these averages for exchange-coupled lattices. These results are illustrated numerically and compared with experiment for the case of polycrystalline MnF_2. In region II, certain broad features of the purely magnetic one-magnon scattering of arbitrarily polarized neutrons by exchange-coupled lattices of the class alluded to previously and by more complex ones are discussed; this scattering is studied in detail for ferromagnets and certain antiferromagnets. A new spin-wave effect is pointed out for polarized neutrons incident on ferromagnets. Brief treatments of the magnetovibrational scattering in regions I and II are also given. (auth)

24784

DEUTERON PHOTODISINTEGRATION IN THE MEDIUM ENERGY RANGE. Gustav Kramer and Carl Werntz (Universität, Heidelberg, Ger. and Univ. of Minnesota, Minneapolis). Phys. Rev. 119, 1627-31(1960) Sept. 1.

The photodisintegration of the deuteron is calculated for the two γ-ray energies in the laboratory of 52.3 and 77.3 Mev, which corresponds to nucleon-nucleon scattering in the laboratory of 100 Mev and 150 Mev. For the ground state the Hulthén wave function with 4% D-state probability is used. The final state is described by the Signell-Marshak phase shifts. The coupling of the scattered waves is taken into account and the retardation effects and all dipole and quadrupole transitions are included. For unpolarized γ rays the total cross section and the angular distribution are calculated. A comparison with the experiments is made. (auth)

24785

INTERACTIONS OF 125-Mev K^+ MESONS IN NUCLEAR EMULSION. O. R. Price, D. H. Stork, and H. K. Ticho (Univ. of California, Los Angeles). Phys. Rev. 119, 1702-9(1960) Sept. 1.

An experimental study of the elastic, inelastic, and charge exchange scattering of K^+ mesons in nuclear emulsion was made based on 100 m of track at an average beam energy of 125 Mev. The elastic scattering and total cross sections were used in a diffuse surface optical model calculation and the inelastic distribution was analyzed by Monte Carlo techniques. With the assumption of S-wave scattering for the $T = 1$ K^+-nucleon state and S- and P-wave scattering for $T = 0$, two best fit $T = 0$ phase-shift solutions were found for two different radius parameters. The dependence upon radius is small and the P-wave phase shifts seem to be important at this energy. (auth)

24786

PHOTOPRODUCTION OF K^+ MESONS IN HYDROGEN. H. M. Brody, A. M. Wetherell, and R. L. Walker (California Inst. of Tech., Pasadena). Phys. Rev. 119, 1710-16(1960) Sept. 1.

The photoproduction of K^+ mesons in hydrogen was measured with the purpose of extending the previous CalTech measurements to smaller angles and obtaining better absolute values for the cross sections. The technique of Donoho and Walker, who used a magnetic spectrometer and a time-of-flight measurement to detect the K^+ mesons, was modified so as to achieve a better discrimination against pions and scattered protons. The results obtained are in fairly good agreement with the more extensive measurements made at Cornell by a somewhat different method. (auth)

24787

EXPERIMENT ON CHARGE INDEPENDENCE IN INTERACTIONS OF NUCLEONS AND PIONS. D. Harting, J. C. Kluyver, A. Kusumegi, R. Rigopoulos, A. M. Sachs, G. Tibell, G. Vanderhaeghe, and G. Weber (European Organization for Nuclear Research, Geneva). Phys. Rev. 119, 1716-25(1960) Sept. 1.

The ratio (R) of the differential cross sections of the reactions $p + d \rightarrow H^3 + \pi^+$ and $p + d \rightarrow He^3 + \pi^0$ was measured at a bombarding energy $E_p = 591$ Mev. The He^3 and H^3 nuclei are detected by the combination of magnetic deflection, time-of-flight measurement, and pulse-height selection. The results are $R = 2.26 \pm 0.11$, 2.10 ± 0.14, and 2.05 ± 0.09 at c.m. angles of the heavy particles of 52, 67, and 143°, respectively. The agreement with the predictions of charge independence is satisfactory when the Coulomb and mass corrections are taken into account. (auth)

24788

PHOTOPRODUCTION OF NEGATIVE AND POSITIVE PIONS FROM DEUTERIUM FOR PHOTON ENERGIES 500 TO 1000 Mev. Gerry Neugebauer, Walter Wales, and R. L. Walker (California Inst. of Tech., Pasadena). Phys. Rev. 119, 1726-35(1960) Sept. 1.

The ratio of the yields of negative and positive pions photoproduced in deuterium was measured at six photon energies between 500 and 1000 Mev and at seven angles between 20 and 160° in the center-of-momentum system of the photon and target nucleon. Pions were selected with a magnetic spectrometer and identified using momentum and specific ionization in a scintillation counter telescope. The spectator model of the deuteron was used to identify the photon energy. Statistical errors were assigned to the π^-/π^+ ratio range between 5 and 15%. The results of the present experiment join smoothly with the low-energy π^-/π^+ ratios obtained by Sands et al. At high energies the π^-/π^+ ratio varies from 0.5 at forward angles and energies near 900 Mev to 2.5 at 160° c.m. and energies 600 to 800 Mev. The cross sections for π^- photoproduction from neutrons were derived from the π^-/π^+ ratio and the CalTech π^+ photoproduction data. The angular distributions for π^- production are considerably different from those for π^+; there is, for example, a systematic increase at the most backward angles. The energy dependence of the total cross section for π^- is similar to that for π^+, although the second resonance peak occurs at a slightly lower energy, and at 900 and 1000 Mev the π^- cross section is smaller by a factor of 1.6. A comparison is made of the cross sections for π^+ photoproduction from hydrogen and deuterium although the accuracy of this comparison is not high. (auth)

24789

ENERGY DEPENDENCE OF THE NUCLEON—NUCLEON PHASE SHIFTS. H. Pierre Noyes (Univ. of California, Livermore). Phys. Rev. 119, 1736-42(1960) Sept. 1.

Starting from the analytic structure of partial wave amplitudes predicted by the Mandelstam representation, relativistic formulas are derived for the energy dependence of the phase shifts for nucleon-nucleon scattering, neglecting inelastic processes. These formulas depend on integrals over functions defined by a (numerically) soluble integral equation whose kernel is determined from the absorptive part of the amplitude in the nonphysical region. The contribution to this kernel from single-pion exchange is explicitly exhibited and the contribution from two-pion exchange is calculable. A generalization of the formulas to include phenomenological constants representing the unknown contribution of multimeson and other particle exchanges is given. The dependence of the phase shifts on these parameters is sufficiently simple to allow the formulas to be used for the least-squares fitting of empirical data. Further, these constants can be varied independently, and as much empirical information as is desired can be incorporated into the formulas without destroying this independence. In the case of coupled states, the phenomenological formulas satisfy unitarity only approximately; this approximation can be removed by a subsidiary calculation, which destroys the independence of the parameters for these states. Because of the neglect of inelastic processes, the range of validity of the formulas is expected to be from 0 to approximately 400 Mev. (auth)

24790

BOUND STATES AND DISPERSION RELATIONS. R. Blankenbecler and L. F. Cook, Jr. (Princeton Univ., N. J.). Phys. Rev. 119, 1745-52(1960) Sept. 1.

A vertex closely related to the Bethe-Salpeter amplitude is discussed in the one meson exchange approximation by dispersion theory methods. Both scalar and spinor cases are treated. The relation between anomalous thresholds and the Schrödinger equation is discussed in some detail. It is shown that dispersion methods can be used to determine bound state parameters. An estimate is made of the asymptotic (D−S) ratio for the deuteron. (auth)

24791

DISPERSION RELATIONS FOR PION–HYPERON PRODUCTION AND A POSSIBLE PION–HYPERON RESONANCE. Richard H. Capps (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 119, 1753-62(1960) Sept. 1.

Approximate P-wave dispersion relations are derived, but not proved, for the processes $\bar{K} + N \rightarrow \pi + \Sigma$ (or Λ) under the assumption that all pion-baryon and K-baryon interactions are of the odd intrinsic-parity, Yukawa type. By comparing these equations with the analogous equations for pion-hyperon scattering, it is shown that a low-energy resonance is likely to occur in a particular combination of the isotopic spin one, $P_{3/2}$, $\pi + \Lambda$, and $\pi + \Sigma$ scattering states; and this resonance should be recognizable in the $\pi + Y$ production processes. Despite complications associated with the unphysical region in the $\pi + Y$ production dispersion relations and with the fact that the K interactions are moderately strong, the resonance should occur in the production process in a direct and simple way. Measurements of the cross section for production of this resonance state can give information about the strengths of the strong interactions, particularly the pion-baryon interactions. The present experimental evidence concerning the existence of such a resonance effect in $\pi + Y$ production is favorable, but inconclusive. A short discussion is given of the additional experimental information needed to test the resonance hypothesis. (auth)

24792

ANALYTIC STRUCTURE OF COLLISION AMPLITUDES IN PERTURBATION THEORY. Richard J. Eden (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 119, 1763-83(1960) Sept. 1.

Some methods are developed for studying the singularities of collision amplitudes in perturbation theory as functions of two of the invariant energies, s, t, and u. It is shown that: (1) there are no singularities other than normal thresholds in the physical regions of the physical sheet; (2) for the equal-mass case there are no singularities in the Euclidean region of the physical sheet; (3) the only straight lines of singularities on the real boundary of the physical sheet are normal singularities in the equal-mass case, and in the general-mass case they are either normal singularities or they intersect the Euclidean region; (4) the curves of singularities on the real s,t plane in the physical sheet do not connect to surfaces extending into the region s real, t complex except at turning points of the curves; (5) turning points of curves of singularities in the physical sheet may occur either when sufficient coincident singularities become also end-point singularities or when there is an accidental relation between the Feynman variables at coincident singularities. The former correspond to anomalous thresholds; and the latter are called spurious turning points; (6) for the equal-mass case there are no anomalous thresholds and no anomalous turning points in the curves of singularities; and (7) spurious turning points do occur in negative spectral regions, but it appears that they may not lead to complex singularities on the physical sheet. There are no spurious turning points in positive spectral regions in low orders in perturbation theory and to all orders for some types of diagram. It is plausible that there are none for any diagram, but this is not proved. The relation of this work to the Mandelstam representation is discussed. All the proven results in this paper are consistent with this representation. Some points are noted which require further investigation before the validity of the representation can be established to all orders in perturbation theory. (auth)

24793

SPIN-ORBIT FORCE AND A NEUTRAL VECTOR MESON. J. J. Sakurai (Univ. of Chicago). Phys. Rev. 119, 1784-5 (1960) Sept. 1.

The coefficient of $(\sigma_1 + \sigma_2) \cdot \hat{n}$ in the pp scattering amplitude at 310 Mev can be completely accounted for by a strongly interacting neutral vector meson (or a sharp three-pion resonance in the T = 0, J = 1 state) of mass $\approx 3\mu_\pi - 4\mu_\pi$. (auth)

24794

APPLICATION OF DISPERSION RELATIONS TO MESON–NUCLEON SCATTERING. Albert C. Finn (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 119, 1786-1802 (1960) Sept. 1.

Relativistic nonforward scattering dispersion relations are used to obtain information about low-energy meson-nucleon scattering. It is determined which of the s-, p-, and d-wave phase shifts are predicted by dispersion theory. Charge independence is assumed. The form of the dispersion relations used is justified by relating the asymptotic energy dependence of the dispersion relation amplitudes to the assumption of a finite range of interaction and to the choice of a particular meson current and the usual equal time commutation relations. The relevence of the analytic properties of the scattering amplitude as a function of momentum transfer is discussed in connection with the partial wave expansion of the dispersion amplitudes. The contribution to the dispersion integrals from energies above the 33 resonance is estimated. (auth)

24795

ANGULAR DISTRIBUTIONS OF THE D (d,n) He^3 REACTION FOR 5- TO 12-Mev DEUTERONS. Murrey D. Goldberg and James M. Le Blanc (Univ. of California, Livermore). Phys. Rev. 119, 1992-9(1960) Sept. 15.

The absolute differential cross section for production of monoenergetic neutrons by the $D(d,n)He^3$ reaction was measured with 5.0, 7.6, 9.6, and 12.2 Mev deuterons. A proton recoil counter telescope was used to detect the neutrons and to separate neutrons from the D(d,np)D breakup reaction. The angular distributions at all energies were very peaked in the forward direction, with a first minimum around 30 to 40 degrees and a subsequent smaller maximum. The angular distributions, transformed to the center-of-mass system, were fitted with the exchange stripping theory of Owen and Madansky, in which stripping from both incident and target deuterons is formally included. Excellent fits were obtained, but it was necessary to monotonically decrease the interaction radius, R_0, with incident deuteron energy. The variation was considerable, from $R_0 = 8.4 \pm 0.2$ fermi at 5.0 Mev to $R_0 = 5.5 \pm 0.2$ fermi at 12.2 Mev. An isotropic contribution of about 3 mb/sr was added to each distribution to obtain the best fit. (auth)

24796

PRODUCTION OF STRANGE PARTICLES BY 1.5-Bev π^- MESONS IN C, Fe, AND Pb. Theodore Bowen (Princeton Univ., N. J.), Judson Hardy, Jr., George T. Reynolds, C. R. Sun, Guido Tagliaferri, Albert E. Werbrouck, and William H. Moore. Phys. Rev. 119, 2030-41(1960) Sept. 15.

The production of $Y^0(\Lambda^0,\Sigma^0)$, θ^0, Σ^- particles by 1.5-Bev

π^- mesons was observed in a multiplate cloud chamber with one-half inch plates of carbon, iron, and lead. The fraction of the inelastic nuclear interactions that resulted in strange particle production remained approximately constant from carbon to lead, with the following yields: Y^0, 1.7 ± 0.4%; θ^0, 1.4 ± 0.5%; Σ^-, 0.2 ± 0.1%. The production angular and momentum distributions are given, along with the distributions obtained from Monte Carlo calculations, which do not include secondary interactions of the strange particles. The yields of hyperons and θ^0's were close to those expected on the basis of the known cross sections in elementary π–p collisions. However, the Σ^-/Y^0 ratio was observed to be much less than expected, indicating at least geometric cross section for $\Sigma^- + p \rightarrow Y^0 + n$. The following lifetimes were obtained: Λ^0, $(2.72^{+0.29}_{-0.27}) \times 10^{-10}$ sec; θ_1^0, $(1.09^{+0.18}_{-0.15}) \times 10^{-10}$ sec. No statistically significant Λ^0 decay asymmetries (up-down, forward-backward, decay proton scattering) were found. Four likely and two possible examples of θ_2^0 interactions were observed; this was in good agreement with the number expected if the interaction cross section was geometric. (auth)

24797

PRODUCTION OF STRANGE PARTICLES BY 2.8-Bev PROTONS IN C, Fe, AND Pb. Theodore Bowen (Princeton Univ., N. J.), Judson Hardy, Jr., George T. Reynolds, Guido Tagliaferri, Albert E. Werbrouck, and William H. Moore. Phys. Rev. 119, 2041-50(1960) Sept. 15.

Observations of Λ^0, θ_1^0, and $\Sigma_\pi^\pm$ particles from 2.8-Bev proton interactions were made in a multiplate cloud chamber with one-half inch plates of carbon, iron, and lead. The $Y^0(\Lambda^0, \Sigma^0)$ and θ^0 cross sections, when compared with those observed for production by 1.5-Bev π^- mesons with the identical arrangement, were lower by at least a factor of four for carbon and a factor of two for lead. Production of $\Sigma_\pi^\pm$'s by protons and pions seemed to be of comparable magnitude in either carbon or lead. Since protons were less effective than pions of similar kinetic energy (in the center-of-mass system) in producing strange particles, it was estimated in the case of incident protons that indirect production of strange particles by intermediate pions accounts for (40^{+28}_{-13})% of the observed particles in carbon and (64^{+21}_{-14})% in lead. The different A dependence of the proton and pion cross sections for producing observable strange particles $(\Lambda^0, \theta_1^0, \Sigma_\pi^\pm \rightarrow \pi^\pm + n)$ may be fitted by a total proton-nucleon direct production cross section of 0.09 ± 0.06 mb. The proton-produced strange particle events were used to compute what would be expected when decay γ rays emitted at 90° to the beam direction were observed in the geometry used by Berley and Collins. The predicted decay curve was in excellent agreement with their observations, and the absolute and relative yields agreed within the estimated experimental uncertainties. (auth)

24798

BRANCHING RATIO OF THE ELECTRONIC MODE OF POSITIVE PION DECAY. H. L. Anderson, T. Fujii, R. H. Miller, and L. Tau (Univ. of Chicago). Phys. Rev. 119, 2050-67(1960) Sept. 15.

A new measurement of the branching ratio $(\pi^+ \rightarrow e^+ + \nu)/(\pi^+ \rightarrow \mu^+ + \nu)$ was completed. A double-focusing magnetic spectrometer was used to observe the spectra of electrons emitted in π decay and in μ decay. The scintillation pulses from the pion and its decay electron were recorded on a traveling-wave oscilloscope. Timing and pulse-height measurements were used to distinguish good events from accidentals. The total number of π–e events recorded in this experiment was 1346, of which 6% were accidentals and 5% were π–μ–e contamination. The branching ratio obtained from an analysis of the data over the π–e and μ–e distributions and corrected to include all decay electrons was $(1.21 \pm 0.07) \times 10^{-4}$. This is close to the result expected for a universal V-A interaction. Kinoshita's calculation, taking into account radiative effects, gave 1.23×10^{-4}. Data in this article also gave for the mean life of π decay $\tau_\pi = (25.6 \pm 0.8) \times 10^{-9}$ second. (auth)

24799

ANTIPROTON-PROTON CROSS SECTIONS AT 1.0, 1.25, AND 2.0 Bev. Rafael Armenteros, Charles A. Coombes, Bruce Cork, Glen R. Lambertson, and W. A. Wenzel (Univ. of California, Berkeley). Phys. Rev. 119, 2068-73(1960) Sept. 15.

The interaction of 1.0, 1.25, and 2.0 Bev antiprotons with protons was studied with the aid of a 4π solid-angle scintillation-counter detector system. The measured total cross sections at the above energies were 100, 89, and 80 mb, respectively. At each energy, the charge-exchange cross section was approximately 5 mb. The total elastic cross sections were 33, 28, and 25 mb, respectively, at the three energies. The angular distribution of elastic scattering was fitted with a simple optical-model calculation. (auth)

24800

MESON-MESON SCATTERING TERM AND LOW-ENERGY PION-NUCLEON SCATTERING. Masao Sugawara and Akira Kanazawa (Purdue Univ., Lafayette, Ind.). Phys. Rev. 119, 2074-6(1960) Sept. 15.

The modified Chew-Low integral equation for the pion-nucleon P-wave scattering amplitudes was derived using the Chew-Low-Wick formalism and assuming a general static interaction Hamiltonian plus the meson-meson scattering term. Essentially the same result was shown to follow from dispersion relations in the no-nucleon-recoil approximation if it was assumed that the almost-forward elastic scattering amplitude became a finite real number at large incident pion energy. If it was further presumed that the meson-meson scattering term alone was responsible for this asymptotic behavior, it could be shown that the extra term to be introduced into the Chew-Low integral equation was just the zero-energy limit of the corresponding term, which was energy dependent in the previous derivation. The modified effective-range expansion of the P-wave phase shift is compared with the data. The S-wave integral equations are also given; they are formally much simpler than those obtained previously in the static model calculation. (auth)

24801

STRONG INTERACTIONS AND A MODEL FOR HYPERONS. I. Goldberg (Univ. of Michigan, Ann Arbor) and Leon F. Landovitz. Phys. Rev. 119, 2077-81(1960) Sept. 15.

Using a 4-dimensional approach, the couplings of the strongly interacting particles were restricted in a simple way that was not inconsistent with experiment. This led to the consideration of a Goldhaber-type model. The gross properties of the hyperons were calculated in the intermediate-coupling approximation for this model. (auth)

24802

GROUND AND EXCITED STATES OF A MANY-BODY SYSTEM WITH SINGULAR INTERACTION. Katuro Sawada (Institute for Advanced Study, Princeton, N. J.). Phys. Rev. 119, 2090-7(1960) Sept. 15.

The procedure to get the ground-state energy and excitation spectrum by looking at the normal modes for the simple excitations of a many-body system was extended and applied to a system with singular interaction. It was shown that the singular two-body interaction could be consistently replaced by the so-called reaction matrix in the equations of motion and in the expressions for the energies of ground and excited states. (auth)

24803

CONTAINMENT OF POSITRONS IN A MIRROR MACHINE. Gordon Gibson, Willard C. Jordan, and Eugene J. Lauer (Univ. of California, Livermore). Phys. Rev. Letters 5, 141-4(1960) Aug. 15.

Positrons emitted isotropically from a uniform volume source were contained in a static magnetic-mirror machine for a mean containment time greater than 10 sec, which corresponds to more than 10^{10} cyclotron periods. This is of practical importance in various research fields such as studies of controlled fusion and studies of the Van Allen radiation belt. A description is given of the apparatus which consists of a magnetic-mirror machine having coaxial 60-in.-mean-diameter coils with 64 in. between coil centers, which are located adjacent to the cyclotron used to produce Ne^{13}. The present results agree with the "fast filling" experiment. They appear to agree with, and to extend, the conclusions of an experiment in which ionization currents created by 18-kev electrons in a mirror machine were measured. (B.O.G.)

24804

NEGATIVE PION-PROTON ELASTIC SCATTERING AT 600 TO 750 Mev. John I. Shonle (Univ. of California, Berkeley). Phys. Rev. Letters 5, 156-9(1960) Aug. 15.

The experiment was conducted to establish the angular momentum at the peaks from elastic scattering of negative pions at 610 ± 20, 655 ± 20, and 750 ± 20 Mev on hydrogen. The pions were focused, deflected, and collimated to give a momentum spread of ±1.5%. The mean beam momentum was measured by three methods; all gave consistent results. The events were given a χ^2 test for elasticity using configuration-dependent errors. Good agreement with the expected χ^2 distribution was found. About 40% of the measured events were elastic. (B.O.G.)

24805

SENSITIVITY OF LOW-ENERGY PION-NUCLEON SCATTERING TO A PION-PION RESONANCE. S. C. Frautschi (Univ. of California, Berkeley). Phys. Rev. Letters 5, 159-61(1960) Aug. 15.

The possibility of explaining nucleon electromagnetic structure quantitatively by introducing a π-π resonance in the T = 1, J = 1 state was recognized by Frazer and Fulco. It is pointed out that in π-N scattering the J = ½, P states are extremely sensitive to the π-π resonance. The π-π resonance parameters that fit the nucleon electromagnetic structure make it difficult to obtain agreement with experiment in several π-N scattering states. This conclusion is especially strong in the $P_{½, ½}$ state where the π-π contribution represents an attractive, long-range interaction that should lead to a large positive phase shift, regardless of what form the unknown short-range interaction may take. . (B.O.G.)

24806

SINGLE PION PRODUCTION IN 0.96-Bev π^--p INTERACTIONS. E. Pickup (National Research Lab., Ottawa), F. Ayer, and E. O. Salant. Phys. Rev. Letters 5, 161-3 (1960) Aug. 15.

Photographs of interactions in a hydrogen bubble chamber irradiated by 0.96-Bev π^- were analyzed. Measurements revealed 415 events of the reaction $\pi^- + p \rightarrow n + \pi^+ + \pi^-$ and 267 events of the reaction $\pi^- + p \rightarrow p + \pi^0 + \pi^-$. It is shown that the angular distributions are quite different and the observed ratio of proton to neutron events with fast π^- is 0.9 ± 0.2. Q values for the different nucleon-pion combinations were computed from the observed momenta. The distributions of Q values are plotted for pion-pion combinations in each reaction, with backward-nucleon events and forward-nucleon events plotted separately. No evidence is seen of peaking for $(\pi^-\pi^+)$, either for forward or backward neutrons or for $(\pi^-\pi^0)$ forward protons. The Q distribution of $(\pi^-\pi^0)$ for backward protons shows a distinct peak at about 325-Mev, which is suggestive of a 600-Mev resonant "di-pion" state (T = 1 or 2). This event is being analyzed. (B.O.G.)

24807

GENERALIZED ISOBAR MODEL, AND THE PIONIC FORM FACTOR OF THE NUCLEON. W. Selove (Univ. of Pennsylvania, Philadelphia). Phys. Rev. Letters 5, 163-5(1960) Aug. 15.

It is pointed out that in a simple model in which the isobar is excited by a virtual pion, the deviations can be understood in a simple way in terms of the decreasing probability of isobar excitation for increasing four-momenta transfer between colliding nucleons. This model predicts moderately well-defined peaks in the inelastic spectrum, corresponding to the various nucleon isobars. These isobars are in turn considered to correspond to the peaks in the π-N cross section; the first three correspond to isobar masses M_1' = 1.23 Bev, M_2' = 1.52 Bev, and M_3' = 1.67 Bev. The predominant features of the experimental results are outlined. (B.O.G.)

24808

ISOTOPIC SPIN DEPENDENCE OF THE PION-NUCLEON HIGHER RESONANCE. Ronald F. Peierls (Univ. of Birmingham, Eng.). Phys. Rev. Letters 5, 166-7(1960) Aug. 15.

A discussion is given concerning the higher resonances in pion-nucleon interactions. Methods of understanding the simultaneous occurrence of the second and third resonances in both the T = ½ and T = 3/2 isotopic spin states are reviewed. The distributions for the $n\pi^+\pi^-$ events are discussed. Present data seem consistent with a picture in which the final states are dominated by the two types of final-state interaction and the amplitude phase is independent of T, but the way in which the final states are generated is not understood. (B.O.G.)

24809

ELECTRON-PROTON SCATTERING AT 900 Mev AND 135°. L. N. Hand (Stanford Univ., Calif.). Phys. Rev. Letters 5, 168-9(1960) Aug. 15.

The results of electron-proton scattering measurements at values of $q^2 > 20f^{-2}$ taken during adjustment runs of the Stanford 900-Mev Linac are reported. The results were normalized with two points at 45°C, thus keeping constant the geometry, the recoil kinematic variation over the acceptance aperture, and the momentum of the scattered electron. The ratio of proton elastic scattering to the Rosenbluth formula at 135°C is given graphically. Calculations were made for the absolute cross sections of six points, assuming 100% Faraday cup-beam collection and 100% counter efficiency. It appears that in the $q^2 = 25f^{-2}$ region at an angle dominated largely by scattering from the proton's magnetic moment, no structure other than that seen in experiments at lower q^2 values has appeared. (B.O.G.)

24810

EVIDENCE AGAINST THE EXISTENCE OF THE B^0 MESON. R. Gomez, H. Burkhardt, M. Daybell, H. Ruderman, M. Sands, and R. Talman (California Inst. of Tech., Pasadena). Phys. Rev. Letters 5, 170-3(1960) Aug. 15.

A report is given of an attempt to observe the production of a B^0 meson in the reaction $\gamma + p \rightarrow B^0 + p$. Protons at a given angle and momentum were detected in coincidence with a photon on the opposite side of the beam. The photon spectrometer was located at such an angle that the maximum energy of the photons resulting from the decay of singly produced π^0 mesons was lower than the maximum energy of those from the B^0 mesons produced by $\gamma + p \rightarrow B^0 + p$, which decayed according to $B^0 \rightarrow \pi^0 + \gamma$. This technique is limited to B^0 mesons of mass >3000 Mev. This experiment becomes insensitive for B^0 masses below 300 Mev. The average cross sections for the photoproduction of B^0 mesons for various mass values are tabulated. (B.O.G.)

24811

SPACE-TIME REFLEXIONS, ISOBARIC SPIN AND THE MASS RATIO OF BOSONS. H. Fröhlich (Univ. of Liverpool). Proc. Roy. Soc. (London), A 257, 147-64(1960) Sept. 6.

It is shown that the usual treatment of space-time reflections is unphysical. A new treatment in terms of continuous transformations involving a new angular space (denoted as isospace) is given. This space permits definition of dynamical variables that can be interpreted in terms of isobaric spin, electric charge, and mass. Application to bosons results in a mass ratio and isobaric spin assignment in perfect agreement with the empirical values. (auth)

24812

ON THE MOTION OF RELATIVISTIC ELECTRONS IN ELECTRIC AND MAGNETIC FIELDS. Antonio Pignedoli. Z. angew. Math. u. Mech. 38, 348-(?)(1958). (Translated from Referat. Zhur. Fiz. No. 12, 1959, abstract No. 26564).

The relativistic equations of motion, which describe the motion of a charged particle in an electromagnetic field (in Newtonian form), are given for Fields E, H are homogeneous, initial conditions arbitrary; central electric field with potential V (r) and homogeneous field; and cylindrical capacitor along the axis of which is applied homogeneous magnetic field (magnetron).

24813

A POSSIBLE NEUTRAL CASCADE MESON DECAY. I. A. Ivanovskaya, E. V. Kuznetsov, E. I. Mal'tsev, A. Prokesh, G. M. Stashkov, and I. V. Chuvilo (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 39, 44-6(1960) July. (In Russian)

An examination of 20,000 photographs obtained by irradiating a xenon bubble chamber with a beam of negative π mesons of 3 Bev/c momentum revealed an event which can be interpreted as a decay of a heavy neutral meson according to the scheme $D^0 \rightarrow K^+ + \pi^- + Q$. The mass of this particle computed on the basis of K^+ and π^- momenta was found to be $m_{D^0} = (660 \pm 50)$ Mev. (auth)

24814

ON π^--MESON DECAYS OF THE H^3_Λ HYPERNUCLEUS. V. A. Lyul'ka. Zhur. Eksptl'. i Teoret. Fiz. 39, 78-9(1960) July. (In Russian)

The ratio of the lifetimes of the decays $H^3_\Lambda \rightarrow He^3 + \pi^-$ and $H^3_\Lambda \rightarrow d + p + \pi^-$ is considered in the impulse approximation for interaction in the proton–deuteron system. It is shown that for a spin $j = 1/2$ of the hypernucleus H^3_Λ the value of this ratio is in good agreement with the experimental value. (auth)

24815

INTERFERENCE BETWEEN COULOMB AND NUCLEAR SCATTERING AT HIGH ENERGIES. B. P. Bannik and V. G. Grishin (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 39, 94-6(1960) July. (In Russian)

Interference between coulomb and nuclear scattering is considered in the quasi-classical approximation. Results of calculations are presented for scattering of 8.7 Bev protons on light and heavy photographic emulsion nuclei. The magnitude and sign of the real part of the amplitude for scattering of protons on protons are discussed. (auth)

24816

RESONANCE MODEL FOR $\pi + N \rightarrow \pi + \pi + N$ REACTION AT 300–450 Mev MESON ENERGIES. V. V. Anisovich (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 39, 97-104(1960) July. (In Russian)

It is assumed that the dependence of the matrix element on energy is due only to resonance interaction between the nucleon and one of the mesons(π) in the final ($3/2$, $3/2$) and that these interacting particles carry off most of the energy of the system. Expressions containing six parameters for the reaction cross sections are written under these conditions. It is shown that the available experimental data agree with the results of the given model. (auth)

24817

ENERGY SPECTRUM OF CASCADE α–PARTICLES IN PHOTOGRAPHIC EMULSION STARS PRODUCED BY HIGH ENERGY PROTONS. V. I. Ostroumov, N. A. Perfilov, and R. A. Filov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 39, 105-7(1960) July. (In Russian)

The energy spectrum of α particles with energies above 30 Mev emitted in the disintegration of heavy photographic emulsion nuclei induced by 140, 200, 360, and 660 Mev protons was computed. The calculations were based on the assumption of single elastic collision between cascade nucleons and intranuclear α particles. The calculated and experimental distributions were compared and found to be in good agreement if the kinetic energy of the α particle in the nucleus was assumed to equal 5 to 10 Mev. (auth)

24818

PERIPHERAL π-MESON-NUCLEON INTERACTION AT HIGH ENERGIES. I. M. Dremin (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz. 39, 130-3(1960) July. (In Russian)

Inelastic π-N interaction is considered for exchange of a virtual π meson. The cross section of a process in which two mesons are produced is computed. The relations between the cross sections of various channels of the process $\pi^- + p \rightarrow N + 3\pi$ are presented. (auth)

24819

RADIATION FROM A CHARGED PARTICLE MOVING THROUGH A PLATE. V. E. Pafomov (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz. 39, 134-7 (1960) July. (In Russian)

The results of calculation of the angular distribution of radiation emitted by a charged particle passing through an isotropic ferrodielectric plate and through a crystalline plate are presented. In the case of thick plates, the main contribution is due to the Vavilov–Cherenkov radiation. An investigation of the solution shows that in the frequency range in which the projections of the wave vector and the Poynting vector on the particle velocity have opposite signs, the Vavilov–Cherenkov radiation is emitted through the back wall of the plate. The radiation emitted by a charged particle moving through thin dielectric plates is also considered. (auth)

24820

VAVILOV–CHERENKOV EFFECT IN UNIAXIAL CRYS-

TALS. Ch. Muzikařzh (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 39, 163-70 (1960) July. (In Russian)

The Vavilov–Cherenkov radiation emitted by an electric charge moving uniformly in an arbitrary direction relative to the optical axis of a uniaxial crystal is considered. The shape of the cones for the normals of the ordinary and extraordinary waves is studied, and simple expressions are derived for the energy of the investigated waves. (auth)

24821

ON THE THEORY OF RADIATIVE PROCESSES IN PIECEWISE HOMOGENEOUS MEDIA. F. F. Ternovskiĭ (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 39, 171-80 (1960) July. (In Russian)

The radiation emitted by an electron passing from a vacuum into a semi-infinite medium is studied considering multiple scattering and polarization of the medium. The probabilities for bremsstrahlung and pair production by γ quantra are computed for plates of finite thickness. (auth)

24822

ON THE MICROSCOPIC THEORY OF THE FERMI FLUID. V. I. Karpman (Gor'kiĭ Minsk Pedagogical Inst., USSR). Zhur. Eksptl'. i Teoret. Fiz. 39, 185-8(1960) July. (In Russian)

A relation is established between the Fermi excitation energies predicted by the Landau theory of the Fermi fluid and by many-particle quantum theory at zero temperature. (auth)

24823

IN REFERENCE TO L. G. YAKOVLEV'S ARTICLE ON "THE CALCULATION OF PHASE INTEGRALS IN COVARIANT FORMULATION OF THE MULTIPLE PARTICLE PRODUCTION THEORY." G. I. Kopylov. Zhur. Eksptl'. i Teoret. Fiz. 39, 209(1960) July. (In Russian)

It is shown that the method of calculating the phase volume by simple integral as suggested by L. G. Yakovlev (Zhur. Eksptl'. i Teoret. Fiz. 37, 1041(1959)) is fulfilled by an incorrect integration expansion into a non-physical state, i.e., into impossible angular and energy magnitudes. Therefore, the suggested formulas are incorrect. (R.V.J.)

24824

STRONG INTERACTION CONSTANTS. I. Yu. Kobzarev and L. B. Okun. Zhur. Eksptl'. i Teoret. Fiz. 39, 210(1960) July. (In Russian)

The constants of strong elementary particle interactions described by eight terms ($nn\pi$, $\lambda\Sigma\pi$, $\Sigma\Sigma\pi$, $\Xi\ \Xi$, $n\lambda k$, $n\Sigma k$, $\Xi\lambda k$, and $\Xi\ \Sigma k$) are analyzed. The absolute term of any of the constants makes no physical sense unless it is the product of terms which in combination contains any particle an even number of times. The constants are important in seeking various symmetry properties describing strong interactions. (R.V.J.)

24825

ELECTROMAGNETIC EMISSION IN ELECTRON DIFFUSION. G. A. Askar'yan (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz. 39, 211-12(1960) July. (In Russian)

Electromagnetic wave emissions in multiple elastic electron scattering by ionizing particles are analyzed. It is postulated that under the above conditions the molecule does not possess strong electron capture ability and that a certain number of the free electrons are multiplying, losing their energy, and rapidly becoming incapable of exciting the molecular medium. This is followed by elastic collisions with strong electron scattering and small energy losses. Electromagnetic emissions are formed when the mean time between collisions exceeds the wave period, the emitted energy is comparable to the stopping energy $\Delta_{\epsilon r} \sim r\epsilon\Delta\omega/c$, where ϵ is kinetic energy, $r_0 = e^2/mc^2$ is the classical electron radius, c is the velocity of light, and $\Delta\omega$ is the spectral width. The collision frequency and wave-frequency ratio does not hold in all cases; for instance, with $l_s \approx 3 \times 10^{-8}$ cm and electron velocity $v \approx 3 \times 10^8$ cm/sec the collision frequency is $v/l_s \geq 10^{16}$, which is about an order of magnitude higher than the light vibration. In order to achieve a more effective electron wave generation, the free electron path is increased by reducing the density of the medium. The intensity of electron emission is also studied as a function of pressure. (R.V.J.)

24826

PROPERTIES OF AXIAL INTERACTION AND $\Sigma \rightarrow \lambda + e + \nu$ DECAY. L. B. Okun. Zhur. Eksptl'. i Teoret. Fiz. 39, 214-16(1960) July. (In Russian)

In a recent preprint, R. Feynman, M. Gell-Mann, and M. Levy postulated the condition $\partial_\alpha f_\alpha = Gfm^2\pi$ for divergence of axial current conserving strangeness that without any further assumption produces the ratio $f = \sqrt{2}\, MG_A /_g G$, where π is the meson field operator, g is the constant of strong π-meson interaction with nucleons ($g^2/4\pi \approx 14$), $G = 10^{-5}\ m^{-2}$ is the universal weak interaction constant, and G_A is the axial constant of β decay ($G_A \approx 1.25G$). It is shown that the postulated hypothesis can be verified by measuring the magnitude of the $\Sigma\lambda\pi$ interaction constant and the probability of the observed decay $\Sigma^+ \rightarrow \lambda^0 + e^\pm \pm \nu$. (R.V.J.)

24827

ON THE BEHAVIOR OF THE TOTAL CROSS SECTION FOR π-MESON PHOTOPRODUCTION AT HIGH ENERGIES. E. D. Zhizhin. Zhur. Eksptl'. i Teoret. Fiz. 39, 219-20 (1960) July. (In Russian)

Photon interactions with nucleons at high energies, $\omega \gg m$, where ω is the photon energy in the center inertia system and m is the nucleon mass are studied. The behavior of the total cross section for π-meson photoproduction is determined by evaluating the contributions from peripheral interactions. The results show that the total cross section at large energies cannot diminish faster than ω_1^{-2}, where ω_1 is the photon energy in the laboratory system. The result is not in good agreement with the statistical hydrodynamic theory of multiple particle production, in which the total cross section for high-energy processes diminishes exponentially with energy increase: $\sigma \sim \exp(-kE^{1/4})$. (R.V.J.)

24828

PROGRESS IN ELEMENTARY PARTICLE AND COSMIC RAY PHYSICS. VOLUME V. J. G. Wilson and S. A. Wouthuysen, eds. Amsterdam, North-Holland Publishing Company and New York, Interscience Publishers, Inc., 1960. 471p.

The chapters of this volume deal with weak interactions (leptonic modes), nucleon-nucleon interactions (phenomenology), antinucleons (theory), cosmic ray jet interactions in emulsions, and absorption and decay of negative muons. (D.L.C.)

Nuclear Properties and Reactions

24829 ANL-6169(p.4-22)
Argonne National Lab., Ill.
DIFFERENTIAL CROSS SECTIONS FOR NEUTRON SCATTERING. R. O. Lane and A. S. Langsdorf, et al.

Results of an analysis of a set of measurements of the angular distributions of neutrons scattered from various nuclei are presented in terms of the coefficients in an expansion of the differential cross sections in a series of Legendre polynomials. The data include a series of measurements taken with broad resolution, the neutron energies ranging from 50 to 2250 kev, and a series of measurements of neutrons scattered at resonances. (auth)

24830 ANL-6169(p.23-35)
Argonne National Lab., Ill.
TIME DEPENDENCE OF RESONANTLY FILTERED GAMMA RAYS FROM Fe^{57}. R. E. Holland, M. Hamermesh, and F. J. Lynch.

It has been shown that the intensity of the gamma radiation transmitted through an absorber that is resonant to the incident radiation does not decrease exponentially with time. Instead the transmitted beam appears initially to decay faster than the rate corresponding to the lifetime of the emitting state. Measurements were made with a source of Co^{57} coplated with Fe^{56} on a thin copper foil and annealed in vacuum at 800°C. Absorbers consisted of rolled foils of Fe^{57}. (W.D.M.)

24831 CU(PNPL)-202
Columbia Univ., New York. Pegram Nuclear Physics Labs.
PROGRESS REPORT FOR OCTOBER, NOVEMBER, DECEMBER 1959 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. 39p. Contract AT-30-1-GEN-72. OTS.

The Nevis cyclotron was shut down, but work proceeded on instrumental improvements and data analysis. Analysis of the gold data was completed. The automatic advance drive for the spectrometer arm of the Columbia neutron spectrometer at BNL was put into operation. Work was continued on transmission measurements. Electric monopole processes were studied following excitation of O^+ states in Ca^{40}, Ge^{72}, and Zr^{90} by inelastic proton scattering. The excitation function for inelastic and elastic scattering of protons from C^{12} was studied at several angles for E_p = 53 to 6.0 Mev. Gamma-coincidence studies and neutron spectroscopy suggested the existence of a previously unreported state at 1.8 Mev in Na^{21}. The reactions $Ne^{20}(p,\gamma)Na^{21}$ and $Ne^{20}(d,n)Na^{21}$ were investigated. An attempt to determine the population of the 7.65 Mev C^{12} state relative to that of the 4.43 Mev state in the $Be^9(\alpha,n)C^{12}$ reaction was made. Preliminary measurements of (He^3,T) reactions on Be^9 were made at energies of 2.5 to 3.5 Mev. Preparation was continued on the He^6 beta-neutrino angular-correlation experiment. Some preliminary investigations were carried out to detect the positrons from the internal-conversion pair from the O^+ to O^+ transition of Ca^{42}. The capture rate of the muon in C^{12} is calculated. A positioning unit for controlling the azimuth of a detector, capable of rotating in alternate directions in steps of 18°, was designed. Several vacuum-tube low-noise preamplifiers were developed. Several transistor coincidence circuits and a transistor limiter were investigated. A 10-channel time-of-flight analyzer was built and is being tested. (For preceding period see CU(PNPL)-199.) (W.D.M.)

24832 INSJ-33
Tokyo Univ. Inst. for Nuclear Study.
NUMERICAL DIFFERENTIAL CROSS SECTIONS OF ELASTIC AND INELASTIC SCATTERINGS OF PROTONS. III—BY NEON IN THE ENERGY REGION OF 7.4 Mev TO 15.5 Mev. S. Kobayashi. July 1, 1960. 16p.

24833 NARF-60-22T
Convair, Fort Worth, Tex.
GAMMA RAYS FROM INELASTIC SCATTERING OF NEUTRONS IN AIR. M. B. Wells. Aug. 12, 1960. 36p. Contract AF33(600)-38946. (FZK-9-150).

A Monte Carlo calculation of the γ rays from neutron inelastic scattering in air is described. The results of these calculations are given in the form of energy and angular distributions of the detected γ-ray fluxes and angular distributions of the detected γ-ray dose rates for point monodirectional neutron sources of 6, 8, 10.9, and 14 Mev at source-detector separation distances of 10, 35, 64, and 100 ft. (auth)

24834 NP-8968(p.11-17)
Naval Research Lab., Washington, D. C.
PHOTODISINTEGRATION OF C^{12} YIELDING ALPHA PARTICLES. M. Elaine Toms.

An attempt was made to verify with data from nuclear emulsions the apparent structure in the $C^{12}(\gamma,3\alpha)$ cross section in the region up to 21-Mev excitation. (W.D.M.)

24835 TNCC(CAN)-24
Atomic Energy of Canada Ltd., Chalk River, Ont.
A REVIEW OF MEASUREMENTS OF THE FISSION CROSS SECTION OF U^{235}. G. C. Hanna. July 1960. 6p. (AECL-873). AECL.

An account is given of visits to several laboratories to discuss the reduction of discrepancies between various values reported for U^{235} cross section. The values of σ_f obtained at Columbia and Harwell are in reasonable agreement with values in the World Consistent Set from BNL-325, Ed. 2, Supplement 1, and Errata. The attempts to reconcile the low Hanford value and the high value from Argonne were not successful. (J.R.D.)

24836 TID-6322
Carnegie Inst. of Tech., Pittsburgh.
NUCLEAR CHEMISTRY RESEARCH AT CARNEGIE INSTITUTE OF TECHNOLOGY, 1959–1960. Progress Report. July 31, 1960. 96p. Contract AT(30-1)-844. OTS.

The laboratories, instruments, and accelerators are described. Individual studies reported include mechanism of (p,pn), (p,2p), and (p,2n) reactions; excitation functions of (p,xp) reactions; excitation functions of light-mass nuclei; recoil of the $Cu^{65}(p,pn)$ reaction; production of carrier-free Mg^{28}; reactions in thick targets by 440-Mev protons; production of Kr^{74}; decay scheme of Fe^{60}; neutron-deficient isotopes of mercury and gold; search for Hg^{206} and Hf^{182}; artificial alpha activity in medium-weight elements; neutron-deficient isotopes of hafnium and lutetium; dating marine sediments; measurement of isotope ratios in siderites and tektites; cosmic-induced radioactivity in meteorites and tektites; x-ray emitters in meteorites; production rates of specific nuclides in meteoroids; search for natural Cm^{247}; chronology of nucleosynthesis and extinct natural radioactivity; and tektite investigations. (W.D.M.)

24837 AEC-tr-4192
Akademiya Nauk S.S.S.R. Institut Fiziki im. P. N. Lebedeva.
ON NEUTRON-DEFECTIVE ISOTOPES OF LIGHT NUCLEI AND THE PHENOMENA OF PROTON AND TWO-PROTON RADIOACTIVITY. V. I. Gol'danskii (Gol'danskiy). (Translation). 1960. 23p. JCL or LC.

Among the specific properties of neutron-deficient isotopes the possible effects of proton and two-proton radioactivity are of special interest. Nuclei are shown for which these effects can be observed. Special properties of the interesting phenomenon of two-proton radioactivity are discussed. (W.D.M.)

24838 JPRS-3601
DEVELOPMENT OF NUCLEAR RESEARCH IN THE CHINESE PEOPLE'S REPUBLIC. San-ch'iang Ch'ien.

Translated from Vestnik Akad. Nauk S.S.S.R. No. 4, 121-4(1960). 6p. OTS.

Achievements in the development of nuclear research in Red China are briefly summarized in terms of experimental nuclear physics, cosmic radiation, theory of atomic nuclei and elementary particles, and the chemistry and use of isotopes. (W.D.M.)

24839

TABLES OF ROTATIONAL ENERGY LEVELS OF DEFORMED EVEN-EVEN NUCLEI. R. B. Moore and W. White (McGill Univ., Montreal). Can. J. Phys. 38, 1149-53(1960) Sept.

A digital computer was used to extend calculations of rotational energy levels of deformed even-even nuclei treated in the manner of Davydov and Filippov. Tables are presented which may be useful for comparison with experimental energy levels of high spin such as are realized in Coulomb excitations by heavy ions. (auth)

24840

CENTRAL THREE-BODY FORCES IN HEAVY NUCLEI. Robert C. Smith and Robert T. Sharp (McGill Univ., Montreal). Can. J. Phys. 38, 1154-67(1960) Sept.

Three-nucleon potentials were calculated using the renormalized static theory of Chew and Low. These potentials were used to evaluate the three-body contribution to the total energy per nucleon in nuclear matter as a function of nuclear density. It was found that although the three-body energy is greater than that predicted by unrenormalized theories by about one order of magnitude as a result of multiple-scattering effects, its dependence on the nuclear density in the region of the equilibrium density is very weak. Three-body forces are therefore not expected to change the saturation properties of nuclear matter as predicted by a hard core potential to any appreciable extent. (auth)

24841

HYPERFINE STRUCTURE AND NUCLEAR MAGNETIC MOMENT OF PLUTONIUM-239. René-Jean Champeau and Simon Gerstenkorn (Centre National de la Recherche Scientifique, Bellevue, France). Compt. rend. 251, 352-4(1960) July 18. (In French)

The precise measurement of the hyperfine structure of two rays of Pu(II) was made with the aid of the Fabry-Perot photoelectric spectrometer. The value of the nuclear magnetic moment was determined to be +0.27 ± 0.06 nuclear magnetons. (tr-auth)

24842

THEORETICAL STUDY OF THE PARAMETERS OF TRIPLE SCATTERING AND DEPOLARIZATION IN PROTON-NUCLEUS ELASTIC COLLISIONS. Philippe Loncke. Compt. rend. 251, 544-6(1960) July 25. (In French)

The D, A, and R parameters of Wolfenstein are calculated in proton-nucleus elastic scatterings at 156 and 310 Mev. The calculations are limited to small angles where the "pulse" approximation is valid. It is shown that D, A, and R are independent of the spin of the target nucleus. Agreement with experimental results is good. (tr-auth)

24843

CONVERSION ELECTRON SPECTRA OF Lu^{171} AND Lu^{172}. Z. Plajner, L. Malý, and M. Vobecký (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 10, 544-5(1960). (In Russian)

Three tantalum targets were bombarded with 660-Mev protons for 4 hr and chemically partitioned 24 hr after irradiation. Conversion-electron spectra of Lu^{169} (1.5 days), Lu^{170} (2 days), Lu^{171} (8.1 days), Lu^{172} (6.7 days), and Lu^{173} (1.4 years) were observed. Relative intensities of Lu^{171} $\rightarrow$ Yb^{171} and Lu^{172} $\rightarrow$ Yb^{172} are tabulated. (R.V.J.)

24844

PRODUCTION OF Eu^{145} BY DEEP SPALLATION REACTION ON Ta. A. A. Bashilov, O. V. Larionov, M. K. Nikitin, and V. B. Smirnov (Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 788-90(1960) July. (In Russian)

Studies were made of Eu^{145} production in the proton spallation of Ta at 660 Mev. The γ radiation was studied by means of a scintillation spectrometer with a NaI crystal with an 8% resolving power for the Cs^{137} 660-kev line. In addition to the known γ lines of Eu^{146}, Eu^{147}, and Eu^{149}, γ lines at 0.89, 1.66, 1.86, and 2.0 Mev were found. The intensity of these new lines diminished with a half life of 5.5 days. An analysis of the curves showed that the 5.5-day activity belongs to Eu^{145}. (R.V.J.)

24845

ELECTRON CONVERSION SPECTRA FOR NEUTRON-DEFICIENT LUTETIUM ISOTOPES AT 1000 to 3500 kev. B. S. Dzhelepov, I. F. Uchevatkin, and S. A. Shestopalova (Mendeleev All-Union Inst. of Metrology, [USSR]). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 802-6(1960) July. (In Russian)

Conversion lines at 1 Mev and over were studied with a triple focusing β spectrometer, using the lutetium fraction from a tantalum target. The small coincidence background enabled measurements of very weak lines. The conversion electron spectrum for Lu^{172} was plotted and five new lines were found. The lines correspond to a half life of 6 days and obviously belong to Lu^{172}. For Lu^{171} the half life was 8.3 ± 0.2 days. The electron conversion spectrum for Lu^{169,170} of 1000 kev and over are tabulated. The positron spectrum at energies over 450 kev showed two components: 2445 ± 20 kev with a half life of 48 ± 3 hr, which belongs to Lu^{170}; and 1250 ± 30 kev with a half life of 34 ± 4 hr, belonging to Lu^{169}. The ratio of S_{1250}/S_{2445} intensities is 3 3.6 ± 1.5. (R.V.J.)

24846

CONVERSION ELECTRON SPECTRUM OF Lu^{167} + Yb^{167}. A. S. Basina, B. S. Dzhelepov, and V. A. Chikhladze (Leningrad State Univ.). Izvest Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 807-10(1960) July. (In Russian)

The conversion electron spectrum of Lu^{167} + Yb^{167} at 30 to 340 kev was analyzed. In addition to the lines appearing in Lu^{167} $\rightarrow$ Yb^{167} $\rightarrow$ Tm^{167} $\rightarrow$ Er^{167} decay, lines for Lu^{169}, Yb^{169}, Lu^{170}, Lu^{171}, and Lu^{172} were found and subtracted as background. The spectrum of Lu^{167} + Yb^{167} was plotted 1 hr after separation. Observations were made of Lu^{167} decay ($T_{1/2}$ = 55 ± 3 min) and Yb^{167} daughter production and decay ($T_{1/2}$ = 18 min). The Lu^{167} spectrum exhibited a γ ray with an energy near 240 kev and the Yb^{167} daughter emitted gammas of ~100 to 170 kev. A series of bright lines were observed after 1 to 6 hr which diminished with a half life of 55 ± 5 min. After the disappearance of the short-period lines, the transition line at 240 kev was clearly discerned. It was concluded that the spectrum represented electron conversion of Lu^{167} in equilibrium with Yb^{167}. (R.V.J.)

24847

DYSPROSIUM FRACTION CONVERSION ELECTRON SPECTRA. A. S. Basina, K. Ya. Gromov, and B. S. Dzhelepov (Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 811-16(1960) July. (In Russian)

A beta spectrometer with a resolving power of ~1.9% was used in investigating the dysprosium fraction which had been chromatographically separated following the fast neutron irradiation of tantalum. Measurements were made about 1 hr following separation. Observations were made of the Dy^{152}, Dy^{153}, Dy^{155}, and Dy^{157} isotopes. The experiments were continued for ~30 hr. The dysprosium lines diminished with half lives of 6 hr, 8 to 11 hr, ~20 hr, and several days. The conversion lines at 227 and 271.4 kev for Dy^{155} and 326 kev for Dy^{157} were clearly observed as well as the line near 82 kev. The Tb^{155} → Cd^{155} lines (T = 5.6 days) at 87, 101, 105, 148, 162, 180, and 263 kev appeared in the spectrum after 50 to 80 hr of irradiation. However, the previously reported lines of Dy^{154} and the daughter lines of Tb^{154} were not observed. The conversion electron characteristics of Dy^{153} and of Tb^{152} are tabulated. Studies of the dysprosium conversion spectrum show that the intensity increases with a 2 to 2.5 hr period and drops with a 19 to 20 hr period. Three isotopes, Tb^{151}, Tb^{152}, and Tb^{154}, with a half life of 18 hr were found. A large number of weak lines (E_e = 433, 448, 455, 492, 532, 543, 570, 652, 664, 765, 780, 853, 864, 873, 894, 927, 950, and 1050 kev) were found and evaluated. The decay scheme of Tb^{152} → Gd^{152} is included. (R.V.J.)

24848

CONVERSION ELECTRON TRANSITIONS IN Tm^{167} AT 106 kev. A. S. Basina and V. A. Morozov (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 817(1960) July. (In Russian)

Evaluations were made of the Tm^{167} transition at 106 kev from the $^{5}/_{2}{}^{+}$ to the $^{3}/_{2}{}^{+}$ level (E2 + m1). (R.V.J.)

24849

REACTIONS (n,2n) AND (γ,n) IN Au^{197}. M. A. Bak, K. A. Petrzhak, and T'ia-mei Ch'êng (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 818-19(1960) July. (In Russian)

Interactions of fast neutrons and γ quanta with Au^{197} were studied using ~14 Mev neutrons from H^{3}(d,n)He^{4} and γ quanta from a tungsten betatron target. Gold foils of 14 mm diameter and 12 to 14 mg/cm^{-2} served as targets. It is shown that only two reactions (n,2n) and (γ,n) take place. The effective cross section of the (n,2n) reaction was found to be 1800 ± 500 mb and for (γ,n), with hν = 17.5 Mev, 460 ± 50 mb. Studies of the β activity of irradiated Au^{197} specimens show two activities with half lives of 9.7 ± 0.3 hr and 5.6 ± 0.1 days. A rough evaluation of the upper boundary of the β spectrum by absorption in aluminum indicates a maximum energy of 250 kev. (R.V.J.)

24850

ROTATION ENERGY OF EVEN-EVEN AND ODD NUCLEI. A. S. Davydov (Moscow State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 820-32(1960) July. (In Russian)

The theory of rotational states in nonaxial even-even nuclei is analyzed on the basis of previously postulated simplifications, considering that in nuclear rotation the intrinsic state does not vary, that the three main moments in nuclear inertia depend on the parameter, which determines the deflection from axial symmetry in the expression I = A sin^{2}[γ(2π/3)i], and that the electric charge is uniformly distributed along the nuclear volume. Various approaches are suggested for further developing the theory of rotational states of nonaxial even-even and odd nuclei. (R.V.J.)

24851

GAMMA RAY SPECTRA IN Cl^{35}(n,γ)Cl^{36} REACTION. L. V. Groshev, A. M. Demidov, and V. N. Lutsenko. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 833-8(1960) July. (In Russian)

A new magnetic spectrometer was used for measuring the γ spectra from thermal neutron capture by Cl^{35}. The intensities of γ lines after subtracting background are plotted between 0.2 and 8.7 Mev. At 1 to 8 Mev the coefficient of γ absorption in the specimen varies by ~1.5 and in the well by ~1.9. Tabulated intensities are expressed as gammas per 100 captures. The order of error in determining absolute intensities is about 10% for the strong lines and probably 50% for lines with hν < 0.6 Mev. Of all captures by both Cl^{35} and Cl^{37}, 99.6% were in Cl^{35}. Hence, all the γ transitions are assigned to Cl^{36}. Energies and intensities are tabulated. (R.V.J.)

24852

GAMMA SPECTRA OF LANTHANUM FRACTION. E. P. Grigor'ev, S. L. Sakharov, and V. O. Sergeev (Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 839-40(1960) July. (In Russian)

An automatic scintillation spectrometer was used in studies of a lanthanum fraction prepared by bombarding tantalum with 660 Mev protons. La^{135} and La^{132} with half lives of 18 hr and 4.2 hr were observed. The intensities of the 470-kev line and the x-ray component of the 18-hr half life were studied and the relative yield of La^{135} was determined. The γ spectrum of the 4-hr lanthanum is very complicated and the resolving power of the spectrometer was not sufficient to determine the relative intensities. Using x-ray and annihilation emission, the number of decays of La^{132} at a given moment was evaluated and correlated to the number of La^{135} decays. The ratio of La^{132} and La^{135} yields was 100 : 80. (R.V.J.)

24853

DETERMINATION OF HALF LIFE PERIODS FOR Dy^{159}, Ho^{160}, Tm^{166}, AND Lu^{173}. E. P. Grigor'ev, O. V. Larionov, M. K. Nikitin, S. L. Sakharov, and O. V. Sergeev (Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 841-4(1960) July. (In Russian)

Dy^{159}, Ho^{160}, Tm^{166}, and Lu^{173} were prepared by tantalum bombardment with 660-Mev protons followed by chemical and chromotographic separation. The mean half life for Dy^{159} was 139 ± 10 days; for Ho^{160}, 4.76 ± 0.10 hr; for Tm^{166}, 7.74 ± 0.08 hr; and for Lu^{173}, 480 ± 30 days. (R.V.J.)

24854

GAMMA SPECTRA OF TANTALUM FRACTION. E. P. Grigor'ev, O. V. Larionov, M. K. Nikitin, S. L. Sakhoarov, and V. O. Sergeev (Leningrad State Univ.). Izvest Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 845-6(1960) July. (In Russian)

Tantalum, bombarded by 660-Mev protons, was chemically separated from reaction products (mostly rare earths and hafnium) and investigated with an automatic scintillation spectrometer. The intensities of the strongest γ lives of the tantalum fraction decreased with an 8 to 11 hr period. Energies and relative intensities of γ lives are tabulated and γ spectra up to 400 kev and 3.1 Mev are plotted. Two isotopes of tantalum were found: Ta^{176} (T = 8 hr) and Ta^{175} (T = 11 hr). The intensities of various lives at 1.5 Mev and above diminished with the identical time period of 8 ± 1 hr. The mass difference of Ta^{176} and Hf^{176} which is over 3 Mev, was evaluated using the data obtained for the Ta^{176} spectrum. (R.V.J.)

24855

MEASUREMENTS OF MEAN LIFETIME OF Lu^{175} AT 113.8 kev LEVEL. V. P. Bozhko, I. I. Zalyubovskiĭ, and A. I. Tutubalin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 847-9(1960) July. (In Russian)

The lifetime of the Lu^{175} first excitation level from Yb^{175} β decay was measured using stilbene crystals with a

FEU-33 photomultiplier as β and γ detector. The scheme of fast and slow coincidences was plotted and the lifetime for the level, considering statistical error, was $T = 0.692\tau_{strong} = (3.6 \pm 0.6) \times 10^{-10}$ sec. Using the obtained T, the ratio of the mixture was determined to be 80% E2 + 20% M1. Such a ratio of E2 and M1 indicates a smaller than theoretical magnetic ratio g_k (R.V.J.)

24856

GAMMA EMISSION OF Zr^{95} + Nb^{95}. N. A. Voinova, B. S. Dzhelepov, and N. N. Zhukovskiĭ (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 850-1(1960) July. (In Russian)

Gamma-electron recoil spectra were measured for a target of Zr^{95} (65-day half life) and Nb^{95} (35-day half life). Observations of the spectrum revealed only two γ lines of 720 ± 5 and 762 ± 2 kev with relative intensities 0.14 ± 0.02. (R.V.J.)

24857

GAMMA RADIATION OF Tb^{160}. N. A. Voinova, B. S. Dzhelepov, N. N. Zhukovskiĭ, and Yu. V. Khol'nov (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 852-7(1960) July. (In Russian)

Tb^{160} γ emission was measured with a γ spectrometer utilizing the electron recoil from a terbium oxide source with ~800 mc activity. The electron recoil spectra were plotted as 200 to 1700 kev and eleven peaks were observed; only the lines $h\nu$ = 298, 392, 1003, and 1311 kev corresponded to the widths of the apparatus, the lines $h\nu$ = 765, 880, 965, 1113, 1179, and 1274 kev are 0.6, 0.3, 0.4, 0.2, 0.2, and 0.4% wider than the apparatus widths, respectively. The 965 kev line consisted of two lines $h\nu$ = 962.5 and 966.3 kev with the intensity ratio 1 : 23. To the right of the 965 kev line, a line of 1003 kev was observed which has not been previously reported. Seventeen lines were analyzed and their energies and relative intensities are tabulated. The Tb^{160} decay scheme is included. (R.V.J.)

24858

SPIN AND PARITY ASSIGNMENT TO LEVELS IN INELASTIC SCATTERING AND "CAPTURE" REACTIONS ON Be^9. O. F. Nemets, L. S. Saltykov, M. V. Sokolov, and Yu. V. Tsekhmistrenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 858-61(1960) July. (In Russian)

Angular distributions of inelastically scattered 6.8 Mev protons and 13.6 Mev deuterons were studied to determine the spin and parity parameters of the 2.43 Mev level. An analysis is made of the (p,d) and (d,t) reaction mechanisms. Measurements were made using deuterons and molecular hydrogen ions in a cyclotron. The angular distribution of inelastic proton scattering and of the direct interaction of incoming protons with nucleons at excited rotational levels of the α particle model and dipole and quadrupole electric interactions are plotted, as well as the angular distribution of inelastic deuterons. The quantum characteristics of the 2.43 Mev level were found to be ${}^5\!/_2{}^+$. In Born approximation the angular distribution for deuteron interactions with neutrons in the ${}^3\!/_2$ state is equal to: $\sigma\ (d,t) \approx 1/k^2 \text{ arc tg}^2\ k/4\gamma\ (\gamma^2,\ (k,R))\ 1/(k^2 + \gamma^2)^2$. (R.V.J.)

24859

SPIN AND PARITY OF C^{13} LEVELS. N. I. Zaika, O. F. Nemets, and M. A. Iserineo (Inst. of Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 862-4(1960) July. (In Russian)

Differential cross sections and angular distributions of protons from $C^{12}(d,p)$ at deuteron energies 4.65. 7.15, 9.55, 12.1, and 13.3 Mev were measured. The cross sections are 24, 18, 14, and 13 mb steradian^{-1} respectively. The order of error is ±30%. (R.V.J.)

24860

SPINS AND PARITIES OF Ti^{47-50} AND Sr^{89} LEVELS. N. I. Zaika and O. F. Nemets (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 865-8(1960) July. (In Russian)

Angular distributions of protons from (d,p) reactions in Ti^{46}, Ti^{47}, Ti^{48}, and Ti^{49} with saturated shell 28 and Sr^{88} with saturated shell 50 were measured. Deuterons were accelerated up to 13.6 Mev. Polystyrene films containing fine, enriched TiO_2 or $SrCO_3$ powder were used as targets. The cross section for $Ti^{46}(d,p)Ti^{47}_{gr}$ was larger than for $Ti^{48}(d,p)Ti^{49}_{gr}$, though Ti^{49} has a normal spin of ${}^7\!/_2$. The Ti^{47} transition to ground state Ti^{48} is also followed by the reconstruction of the ${}^7\!/_2$ configuration. The magnitude of the neutron transmitted angular moment, lp = 3, is in agreement with a ground state for Ti^{48} 0^+, and for the 1.33 and 2.31 Mev levels the characteristics 1^+, 2^+, 3^+, and 4^+ are possible. However, if at ground state Q = 8.14 Mev, then the energy of the Ti^{48} first excited state is 1.33 and not 0.986 Mev as was previously reported. For the Ti^{48} ground and excited states at 1.35, 1.7, and 2.4 Mev the magnitudes of transmitted angular moments are 3, 1, 1, and 1 + 3 respectively; and possible quantum characteristics are ${}^5\!/_2{}^-$ or ${}^7\!/_2{}^-$, ${}^1\!/_2{}^-$ or ${}^3\!/_2{}^-$, ${}^1\!/_2{}^-$ or ${}^3\!/_2{}^-$, and ${}^1\!/_2{}^-$ or ${}^3\!/_2{}^-$, ${}^5\!/_2{}^-$ or ${}^7\!/_2{}^-$. The quantum characteristic of the Ti^{50} ground state is 0^+ (even-even nucleus). For the 1.58 and 2.8 Mev levels l_n = 1 and 0, and the quantum characteristics are 2^+, 3^+, 4^+, 5^+, and 3^-, 4^- respectively. Proton angular distributions for ground and excited state of Sr^{89} are plotted. l_n equals 2 and 0 respectively, and the quantum characteristics are ${}^3\!/_2{}^+$ or ${}^5\!/_2{}^+$ and ${}^1\!/_2{}^+$. (R.V.J.)

24861

SPIN OF Mg^{24} LEVEL AT 1.38 Mev EXCITATION STATE. O. F. Nemets and G. A. Prokopets (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 869-71(1960) July. (In Russian)

Angular distributions of inelastically scattered deuterons and protons at small angles were measured in an attempt to determine the Mg^{24} spin at 1.38-Mev excitation. The measurements were made at 2.5 to 140° increments of 2° for small and 5° for large angles. The best agreement with theory was achieved with the parameters $a = 6.3 \times 10^{-13}$ cm and 7×10^{-13} cm, which coincide with experiments at $\theta = 20°$. In both events the angular moment was 2. Correlations of experimental data with theory show that direct interactions prevail in 13.6 Mev inelastic deuteron scattering at the 1.38-Mev level. Moreover, small angle scattering results mostly from electric interactions. Comparison of the theoretical and experimental data confirm the quantum characteristic 2^+ for the level. (R.V.J.)

24862

SPINS AND PARITIES OF Ca^{41} LEVELS. N. I. Zaika, O. F. Nemets, and V. S. Prokopenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 872-3(1960) July. (In Russian)

The angular distributions of protons from $Ca^{40}(d,p)Ca^{41}$ for the ground and 1.95 and 2.42 Mev excited states were studied with a cyclotron beam of E_d = 13.6 Mev. The geometry of the experiment and the spectrometer used were identical to those of previous works except for a polystyrene absorber which cut off the deuterons. The angular moments contributed by neutrons are 3, 1, and 1 for the 1.95 and 2.42 Mev and ground states. With 0^+ quantum characteristics, the magnitudes ${}^5\!/_2$ or ${}^7\!/_2$; ${}^1\!/_2{}^-$ or ${}^3\!/_2{}^-$; and

$^1/_2{}^-$ or $^3/_2{}^-$ are assigned. The shell model for a spherical case assigns for these states the values $^7/_2{}^-$, $^3/_2{}^-$, and $^1/_2{}^-$. (R.V.J.)

24863

ANGULAR DISTRIBUTION OF PROTON IN INELASTIC SCATTERING ON CHROMIUM AND NICKEL. M. V. Pasechnik, N. N. Pucherov, and V. I. Chirkov (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 874-6(1960) July. (In Russian)

Inelastic scattering of 6.8 Mev protons on chromium and nickel isotopes was investigated. A typical energy spectrum of 6.8 Mev protons scattered on Cr^{52} at 90° was plotted as well as the angular distributions of protons scattered on Cr^{52} and Ni^{58} at the 1.45 Mev (2^+) levels. Partial cross sections for inelastic proton scattering, evaluated for Ni^{58} at the 1.45 Mev level, Ni^{60} at the 1.33 Mev level, and Ni^{62} at the 1.17 Mev level at 140 to 160°, were slightly larger (30 mb steradian^{-1}) than for the lighter isotopes (20 mb steradian^{-1} for Ni^{60} and 10 mb steradian^{-1} for Ni^{58}). (R.V.J.)

24864

ENERGY LEVELS OF Cl^{35}. Yu. P. Antuf'ev, A. K. Val'ter, V. Yu. Gonchar, E. G. Kopanets, A. N. L'vov, and S. P. Tsytko (Khar'kov Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 877-83(1960) July. (In Russian)

The proton reaction $S^{34}(p,\gamma)Cl^{35}$ (Q = 6.373 Mev) was used in investigating the levels and quantum characteristics of the Cl^{35} nucleus. The excitation functions and spectra and angular distribution of γ rays were measured. The thickness of the target corresponded to the 4- to 5-kev resonance maximums for 1.0-Mev protons at 250° temperature. The resonance half-width at proton energies of 1020, 1158, 1328, and 1547 kev are 8, 22, 9, and 20 kev. Proton resonance energies and characteristics of Cl^{35} levels from 715 to 1418 kev are tabulated. The scheme of Cl^{35} transitions is plotted. (R.V.J.)

24865

ELASTIC SCATTERING OF PROTONS BY Ne^{20}. A. K. Val'ter, A. S. Deĭneko, P. V. Sorokin, and A. Ya. Taranov. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 884-6(1960) July. (In Russian)

Measurements were made of the p-Ne^{20} cross sections at 55, 90, 125, 141, and 151° in the center of mass system at proton energies of 1.6 to 3.4 Mev. Five well defined resonances were observed. The results showed for the E_p = 1.95 Mev resonance, $\Gamma_p^2/\Gamma = 1 \pm 0.2$; for E_p = 2.15 Mev, $\Gamma_p/\Gamma = 18 \pm 0.2$; the lower maximums for the complete level widths were $\Gamma \geq 1$ kev and $\Gamma \geq 18$ kev respectively. The level width at 4.18 Mev and the $^3/_2$-spin and parity lead to the assumption that protons scattered by Ne^{21} will be polarized in a wide range of energies at E_p = 1.8 Mev. Polarization at 90° was calculated as a function of energy between 1 and 1.8 Mev. At larger energies the influence of the 1.96- and 2.15-Mev resonances should be considered. Proton polarization varies smoothly with energy and reaches 70%. Elastic scattering on the Ne^{20} nucleus can be utilized for determining proton polarization. (R.V.J.)

24866

PROTON ELASTIC SCATTERING BY NUCLEI. A. P. Klyucharev (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 887-90(1960) July. (In Russian)

The angular distributions of protons elastically scattered by Cr^{52}, Cr^{53}, Co^{59}, Ni^{58}, Ni^{60}, Ni^{62}, Cu^{63}, and Cu^{65} were measured for proton energies of 5.45 and 6.8 Mev and by Li^6, Li^7, Co^{59}, Cu^{63}, Cu^{65}, Ge^{73}, Ge^{74}, Cd^{111}, Cd^{113}, Cd^{116}, Sn^{116}, Sn^{117}, Sn^{118}, Sn^{119}, Sn^{120}, Sn^{122}, Sn^{124}, Pb^{207}, Pb^{208}, Bi^{209}, and U^{238} for 19.6-Mev protons. Linear accelerators of 5.5 and 19.6 Mev and a 6.8 Mev cyclotron were used as fast proton sources. Proton scatterings were recorded at various angles by a scintillation spectrometer and nuclear emulsions. The recording methods and the target thicknesses produced accurate recordings of elastically scattered protons, discriminating the inelastic. It was observed that at 19.6 Mev, $Cd^{111,113,116}$ defraction scattering is identical except for slight shifts at the extremes (depending on mass number). However, Cd^{111} has five energy levels up to 600 kev, Cd^{113} has four, and Cd^{116} has only one. The curves of angular dependence for Cd^{116} and Sn^{116} are identical but the absolute value $\sigma(\theta)\sigma_{Rh}(\theta)$ for one nucleus is about twice as large as for the other. Quantitative and qualitative differences in the angular dependence $\sigma(\theta)\sigma_{Rh}(\theta)$ at large angles for even-even nuclei (Cr^{52}, Ni^{58}, Ni^{60}, and Ni^{62}) and odd-odd (Co^{59} and Cu^{65}) were observed at energies of 5.45 Mev. Consequently, even one unit change in neucleon number alters the angular distribution in proton scattering at energies lower than the potential barrier. (R.V.J.)

24867

INVESTIGATIONS OF K^{41} LEVELS BY MEANS OF $Ar^{40}(p,\gamma)K^{41}$ REACTION. A. K. Val'ter, Yu. P. Antuf'ev, V. Yu. Gonchar, A. N. L'vov, E. G. Kopanets, and S. P. Tsytko (Inst. of Physics and Tech., Academy of Sciences, Ukrairian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 891-4(1960) July. (In Russian)

The excited states of K^{41}, composed of 19 protons and 22 neutrons with the ground state configuration of $(\pi d_{3/2})^3(\nu f_{7/2})^2$ and spin and parity $^3/_2{}^+$, were studied using the reaction $Ar^{40}(p,\gamma)K^{41}$ to determine the high and low resonance levels of the nucleus as well as its quantum characteristics. The γ spectrum for resonance energy E_p = 1107.5 kev and the excitation levels are plotted and analyzed. (R.V.J.)

24868

EXPERIMENTAL AND THEORETICAL COEFFICIENTS OF MIXED STATES AND POLARIZATION OF NUCLEONS IN DEFORMED NUCLEI. D. A. Varshalovich (Leningrad Inst. of Physics and Tech.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 895-8(1960) July. (In Russian)

Nucleon polarization in deformed nuclei is determined as the doubled mean value of the spin projection on the nuclear symmetry axis: $p \equiv p\ 2 <s> = \alpha^2\beta^2$, $-1 \leq p \leq 1$; and in reverse $\alpha^2 = (1 + p/2)$, $\beta^2 = (1 - p/2)$. Magnitudes of α, β and p are calculated on the basis of Nilsson wave functions; however, there are reasons why the empirical wave functions of nuclei may differ from Nilsson's. Correlations were made of the theoretical and empirical polarization magnitudes and theoretical and empirical values of α and β. Data for the correlations on odd-Z and odd-N nuclei are tabulated and analyzed. The polarization magnitudes p and α and β coefficients determined with the experimental value μ (magnetic moments of deformed nuclei) indicate that Nilsson's function is in good agreement with the experiment, and the classification of states using asymptotic quantum numbers show satisfactory results and selection rules with Λ and Σ can be fulfilled. (R.V.J.)

24869

INTERNAL BREMSSTRAHLUNG ACCOMPANYING THE P^{32} β DECAY. K. A. Korotkov and A. M. Chernikov (Voronezh State Univ., USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 899-902(1960) July. (In Russian)

The spectrum of internal bremsstrahlung following P^{32} β decay was studied for the energy range 20 to 1215 kev. A single-channel scintillation spectrometer with NaI(Tl) crystal, 29 mm in diameter and 14 mm thick and in an aluminum container, was used. Spectra from two sources (with 2 and 0.11 mc activity) were studied. The spectrometer was calibrated by the γ lines from Zn^{65} (1.12 Mev), Cs^{137} (662 kev), Au^{198} (412 kev), Cr (323 kev), and Hg^{203} (279 kev) and by the x ray line $K_\alpha Pb$ at 75-kev. The total internal bremsstrahlung quanta per β decay was equal to 2.89×10^{-3} mc^2/β, which is 22% larger than the theoretical value 2.37×10^{-3} mc^2/β. The results are in good agreement with the data of K. Liden et al. (Arkiv Fyz. 7, 427, 1954). (R.V.J.)

24870

EXCITATION OF COLLECTIVE NUCLEAR LEVELS IN STRIPPING REACTION. A. M. Korolev (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 903-11(1960) July. (In Russian)

Stripping reaction excitation of collective nuclear levels were analyzed in the extreme case of intermediate bonding at the weak bond side when the collective oscillation spectrum is basically vibrational, the initial nucleus is spherical, and the residual nucleus, after the neutron capture, is slightly deformed. Reactions (d,p) in even-even spherical nuclei, with a number of nucleons above the closed nucleon shell, and the neutron and proton matrix element transitions are studied as well as the angular distribution of protons from stripping reactions. (R.V.J.)

24871

BETA TRANSITION IN WEAKLY DEFORMED NUCLEI. B. D. Konstantinov and V. I. Ovcharenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 912-19(1960) July. (In Russian)

Nuclear matrix elements are calculated using previously reported data on wave functions and energy levels of odd-odd nuclei. Calculations were done for the case of intermediate bonding at the weak bond side and also considering nonadiabatic terms and two-phonon states. The work is limited to nonrelativistic approximation of matrix elements in nonforbidden or first-forbidden β transitions in scalar and tensor interactions with electron-neutron fields. (R.V.J.)

24872

MAGNETIC AND QUADRUPOLE MOMENTS IN WEAKLY DEFORMED NUCLEI. Yu. L. Gurin, A. M. Korolev, and B. D. Kostantinov (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 920-3(1960) July. (In Russian)

The magnetic and quadrupole moments in deformed nuclei with strong collective nucleon interaction were calculated to verify the accuracy of data obtained with the statistical nuclear model. Data for odd-neutron and odd-proton Sr, Zr, Mo, Ba, Nd, Hg, Pb, Co, Cu, In, Sb, Tl, and Bi, obtained by a single shell model and the statistical model, show that the statistical model explains better the magnetic and quadrupole moment data for weakly deformed nuclei. Theoretical magnitudes for magnetic moments found by the statistical model are in good agreement with experimental values, with the exception of Nd^{143}, Hg^{20}, and Bi^{209}. The first collective level of Pb^{208} is not known and the selected hydrodynamic value hw = 1.3 Mev is obviously not correct. Thus the magnetic moment magnitude for Bi^{209} is two-fold smaller. Nd^{143} is found at the boundary of deformed nuclei where the use of the model is not quite legitimate. For the quadrupole moments the agreement between theory and experiment is somewhat worse. (R.V.J.)

24873

THE RATIO NUMBER OF X-RAY K- AND L-EMISSION QUANTA FOR CERTAIN NEUTRON-DEFICIENT ISOTOPES. V. D. Vitman, B. S. Dzhelepov, A. A. Pavlov, S. V. Semenov, and S. A. Shestopalova (Mendeleev All-Union Research Inst. of Metrology [USSR]). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 934-8(1960) July. (In Russian)

A proportional counter was used for measuring the relative intensities of x-ray K- and L-emission of Ho^{160}, Dy^{159}, Nd^{140} + Pr^{140} and Sm^{145}. All sources were prepared by tantalum target bombardment with 660-Mev protons. The apparatus was calibrated with the x-ray lines of Zn^{65}(K_α Cu = 8.05 kev), Se^{75}(K_α As = 10.5 kev), In^{144}(K_α In = 24.1 kev), Cs^{137}(K_α Ba = 30.8 kev), and Sm^{145}(K_α Pm = 38.4 kev). The relative half-line of the arc lines is 15% for $h\gamma = 10.5$ kev and 12% for $h\gamma = 24.1$ kev. The ratio of quantum numbers for x-ray L- and K-emissions are proportional to the ratio of measured K and L line regions: $N_L/N_K = k\, S_L/S_K$. The ratios N_L/N_K and λ_L/λ_K are tabulated for Nd^{140} + Pr^{140}, Sm^{145}, Dy^{159}, and Ho^{160}. The λ_L/λ_K determination with N_L/N_K is not satisfactory for small magnitudes of λ_L/λ_K and can be used satisfactorily only in anomalous cases when $\lambda_L > \lambda_K$. (R.V.J.)

24874

APPROXIMATE EMPIRICAL FORMULA FOR INTERNAL CONVERSION COEFFICIENTS. Minoru Okada (Government Chemical Industrial Research Inst., Tokyo). J. Inorg. & Nuclear Chem. 14, 306-7(1960) Aug. (In English)

The internal conversion coefficient is one of the important factors upon which the detection limit for a radionuclide depends when a γ-scintillation spectrometer is employed for detection. This coefficient was determined for a relatively small proportion of all γ rays. About 448 can be found in the Table of Isotopes, including cases in which the coefficient can be estimated from related data. If the coefficient is expressed as a function of γ energy, the coefficients for other energies may be estimated to some extent. The values were plotted, and a formula was derived which has a probability of 95%. Examples of the application of the formula are given. (B.O.G.)

24875

(γ,p) REACTIONS ON Na^{23}, K^{39}, I^{127}, AND Cs^{133}. Lajos Keszthelyi and Janos Eron. Magyar Fiz. Folyóirat 6, 553-64(1958). (Translated from Referat. Zhur. Fiz. No. 12, 1959, abstract No. 26883),

Among the reactions produced by γ rays, the most difficult to interpret are the γ,p reactions. In particular, the effective cross sections and also the energy spectrum of the protons for these reactions cannot be explained by using the statistical model, which gives a good account of itself in the case of γ,n reactions. In work with γ rays, obtained from the reaction $Li^7(p,\gamma)Be^8$, the following reactions were observed: $Na^{23}(\gamma,p)Ne^{22}$, $K^{30}(\gamma,p)A^{38}$, $I^{127}(\gamma,p)Te^{126}$, and $Cs^{133}(\gamma,p)X^{132}$. The measured proton spectra do not agree with the statistical model.

24876

NUCLEAR MAGNETIC SHIELDING OF A HYDROGEN ATOM IN (1) AN ELECTRIC FIELD-GRADIENT AND (2) A CAGE. A. D. Buckingham and K. P. Lawley (Univ. of Oxford). Mol. Phys. 3, 219-22(1960) May.

The ground state wave function of a hydrogen atom in an electric field-gradient (F′) is obtained, correct to the first power in F′, and the nuclear magnetic screening constant σ evaluated, The F′ contribution to σ vanishes if all directions of F′ relative to the applied magnetic field are equally probable. The influence of a uniform compression of the hydrogen atom on σ is examined. This effect, which will predominate at sufficiently high pressures, causes a decrease in the electronic polarizability but an increase in σ. (auth)

24877

REMARKS ON THE THEORY OF MULTIPLE SCATTERING IN NUCLEI. Li-ming Yang. Pei Ching Ta Hsüeh Hsüeh Pao—Tza Jan K'o Hsüeh 4, 277-86(1958). (Translated from Referat. Zhur. Fiz. No. 12, 1959, abstract No. 26875).

A theory is constructed for multiple scattering of particles in nuclei, generalizing the Watson theory. If exchange effects are not taken into account, it is possible to separate in the multiple-scattering matrix an elastic and inelastic part. The elastic part of the multiple-scattering matrix (including also the potential of the optical model) depends both on the elastic and on the inelastic parts of the single scattering. By successive approximations it is possible to determine the coherent potential of scattering V_c from the total scattering matrix. A procedure for determining the successive approximations for V_c is indicated. The zero approximation corresponds to the improved Watson solution. The higher approximations can be found successively and all can be expressed in terms of the operator t_c introduced by Watson.

24878

HALF-LIFE OF IODINE-125. C. M. E. Matthews (National Inst. for Medical Research, London). Phys. in Med. Biol. 5, 45-7(1960) July.

The half-life of I^{125} was found to be 57.4 ± 0.2 days. The simultaneous use of I^{125} and I^{131} in biological experiments is discussed. (auth)

24879

COMPETITION BETWEEN FISSION AND NEUTRON EMISSION IN EXCITED HEAVY NUCLEI. Manfred Lindner (Univ. of California, Livermore) and Anthony Turkevich. Phys. Rev. 119, 1632-43(1960) Sept. 1.

The yields of the disintegration products of uranium and thorium bombarded with 340-Mev protons were calculated from the intranuclear-cascade results of Metropolis et al. together with several alternative treatments of neutron evaporation. Several different assumptions concerning fission as a competing process were tested. The yields resulting from these different assumptions were compared with the experimental results of Lindner and Osborne. The results point to the nonvariance of the quantity Γ_n/Γ_f with change in nuclear excitation in the energy range below 100 Mev. They also indicate that the model used for calculating these high-energy reactions in heavy nuclei is poor for estimating yields of nuclei very close to the target nucleus and of nuclei with charge much less than that of the target nucleus. This inadequacy appears to be associated with the cascade stage of the calculation. (auth)

24880

CROSS SECTION FOR THE REACTION $C^{13}(\gamma,n)$ AT 6.4 Mev. R. D. Edge (Oak Ridge National Lab., Tenn.). Phys. Rev. 119, 1643-4(1960) Sept. 1.

Using radiation from the $F^{19}(p,\alpha\gamma)$ reaction at 874-kev proton energy, the cross section for the reaction $C^{13}(\gamma,n)$ was found to be 94.1 ± 10 microbarns for a weighted γ-energy of 6.4 Mev. The neutrons emitted from a target enriched in C^{13} were detected by an arrangement of BF_3 counters embedded in wax to give a 4π geometry. (auth)

24881

ALPHA DECAY OF Np^{235}. J. E. Gindler and D. W. Engelkemeir (Argonne National Lab., Ill.). Phys. Rev. 119, 1645-9(1960) Sept. 1.

The α decay of Np^{235} was found to be complex. Four groups were identified with energies of 4.864, 4.925, 5.015, and 5.095 Mev. The relative abundances of the respective groups are 0.8, 11.8, 83.6, and 3.8%. Hindrance factors calculated on the basis of a 7×10^4 year α half life for Np^{235} are 35, 6.1, 3.3, and 250, respectively. The electron capture decay energy of Np^{235} was determined to be 163 ± 16 kev based on a closed cycle calculation and the assumption that the 5.095-Mev α transition is to the ground state of Pa^{231}. (auth)

24882

INTERACTION OF 6- TO 14-Mev DEUTERONS WITH HELIUM THREE AND TRITIUM. L. Stewart, J. E. Brolley, Jr., and L. Rosen (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 119, 1649-53(1960) Sept. 1.

The angular distributions of the cross sections for the $T(d,n)He^4$ and $He^3(d,p)He^4$ reactions were measured at five incident deuteron energies between 6 and 14 Mev. The data were fitted with Legendre expansions. A search for excited states in He^4 near 22 Mev and for evidence of the formation of H^4 gave negative results. (auth)

24883

STUDY OF (He^3,d) AND (He^3,t) REACTIONS IN LIGHT NUCLEI AT 25 Mev. H. E. Wegner and W. S. Hall (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 119, 1654-65(1960) Sept. 1.

Angular distributions for the $Be^9(He^3,d)B^{10}$, $Be^9(He^3,t)B^9$, $C^{12}(He^3,d)N^{13}$, and $Ca^{40}(He^3,d)Sc^{41}$ reactions were measured at 25 Mev and also at 21 Mev for the carbon reaction. It was found that the angular distributions were strongly peaked forward, exhibited diffraction-like structure, and were asymmetric about 90°. The minimal positions of the angular distributions could be fitted with spherical Bessel functions of the appropriate order l, the angular momentum transfer of the ingoing proton. This analysis resulted in the same interaction radius for various levels in each of these reactions. The best-fit interaction radius for each case was 6.17, 5.91, 6.23, and 7.29 fermis, respectively. The Butler stripping theory was also fitted to the angular distributions; however, the average decrease of the angular distributions did not agree with the predicted decrease except in one case. The reactions exhibited the general characteristics of a direct process and could be predicted qualitatively with the simple form of direct interaction theories. The experimental equipment and the method of data analysis, using computer codes, is described. The ground-state Q values were measured for the $Ca^{40}(He^3,d)Sc^{41}$, $Ca^{40}(d,n)Sc^{41}$, and $O^{16}(He^3,d)F^{17}$ reactions. Q values for levels excited by the $Ca^{40}(He^3,d)Sc^{41}$ reaction were also measured. (auth)

24884

ANGULAR CORRELATION OF ANNIHILATION RADIATION IN SULFUR AND ITS COMPOUNDS. P. Colombino (Università, Turin), I. Degregori, L. Mayrone, L. Trossi, and S. DeBenedetti. Phys. Rev. 119, 1665-6(1960) Sept. 1.

The angular correlation of annihilation radiation in elemental sulfur and in several sulfur compounds was found to be practically the same in all samples studied. The observed correlation is similar to that observed with chlorine salts; a similarity that, in some cases at least, may be correlated to the similarity of the ions Cl^- and S^{2-}. (auth)

24885

CHARGED PARTICLES FROM THE 14-Mev NEUTRON INTERACTION WITH ZIRCONIUM. Se Hee Ahn, J. R. Hearst, J. H. Roberts, and E. N. Strait (Northwestern Univ., Evanston, Ill.). Phys. Rev. 119, 1667-70(1960) Sept. 1.

This experiment was performed in order to investigate the mechanism of the zirconium (n,p) and (n,np) reaction at 14 Mev. The energy distribution of particles interpreted as protons is found to peak at about 2 Mev. The cross section for charged particle emission was found to be 87 ± 22 mb. The angular distribution below 8 Mev is consistent with the compound nucleus model, but above 8 Mev a forward peak is observed. (auth)

24886

MULTIPLE SCATTERING CORRECTION FOR PROTON RANGES AND THE EVALUATION OF THE L-SHELL CORRECTION AND I VALUE FOR ALUMINUM. Hans Bichsel and Edwin A. Uehling (Univ. of Washington, Seattle). Phys. Rev. 119, 1670-80(1960) Sept. 1.

Multiple scattering corrections to proton range-energy measurements are discussed. Curves are plotted which give the fractional transmission of protons through a finite thickness of stopping material as a function of the initial proton energy and for various values of the ratio of the straggling and multiple scattering parameters. An application of these results to particular experimental situations shows that the Molière multiple scattering distribution gives a nearly correct representation of the experimental data on transmission and that a simple exponential distribution is not satisfactory. The case of straggling in gold is discussed in detail. Application of the results to the experimental range-energy relation in aluminum for protons of energy lying between 1 and 20 Mev is made. The experimental ranges can be described consistently with a mean excitation potential I = 163 ev and with reasonable values of the L-shell binding energy correction. (auth)

24887

NEUTRONS FROM THE He^3 BOMBARDMENT OF O^{16} AND Mg^{24}. F. Ajzenberg-Selove (Haverford Coll., Penna.) and K. L. Dunning. Phys. Rev. 119, 1681-5(1960) Sept. 1.

A thin target of magnesium oxide enriched in Mg^{24} was bombarded by 5.52-Mev He^3 particles. The outgoing neutrons were measured by the method of proton recoils in photographic emulsions. The ground-state Q value of the $O^{16}(He^3,n)Ne^{18}$ reaction was determined in this experiment to be -3.19 ± 0.04 Mev. The Q value of the $Mg^{24}(He^3,n)Si^{26}$ ground-state reaction is 0.08 ± 0.08 Mev. The mass of Si^{26} is then 25.99232 ± 0.00007 amu (C^{12} standard). In addition, excited states of Si^{26} at 1.78 ± 0.06 and 2.79 ± 0.08 Mev were observed. Angular distributions of these four neutron groups and of the $C^{12}(He^3,n)O^{14}$ ground-state group are also reported; in all but one case, the distributions are peaked in the forward direction. (auth)

24888

SPONTANEOUS FISSION YIELDS OF Cf^{252}. W. E. Nervik (Univ. of California, Livermore). Phys. Rev. 119, 1685-90(1960) Sept. 1.

A radiochemical investigation was made of the fission yield curve for the spontaneous fission of Cf^{252}. One source of 1×10^6, another of 2×10^7, and a third of 7×10^7 fissions per minute were used to obtain the data. Thirty-six radioactive nuclides between mass numbers 77 and 166 were separated, identified, and their fission yields calculated. Upper limits were set for nine other nuclides. The fission yield curve has maxima of 6.05% at masses 107 and 141 with a full width at $\frac{1}{10}$ maximum of each peak of approximately 27 mass units. There is a very narrow trough with a minimum value of $\leq 8 \times 10^{-3}$% at mass number 124. In addition, although the curve as a whole is symmetrical about mass 124, each peak is not symmetrical about its own maximum; it is spread significantly toward the most asymmetric fission modes. A small fine-structure peak was observed at mass 113. No evidence was seen of activities that could be ascribed to ternary fission events; upper limits of 10^{-4}% fission yield were set for individual nuclides between mass numbers 28 and 72. (auth)

24889

ESTIMATE OF THE NUCLEAR MOMENT OF Ni^{61} FROM ELECTRON SPIN RESONANCE. J. W. Orton, P. Auzins, and J. E. Wertz (Univ. of Minnesota, Minneapolis). Phys. Rev. 119, 1691(1960) Sept. 1.

The electron spin resonance spectra of nickel and cobalt were studied in single crystals of MgO. Hyperfine structure was detected from the Ni^{61} isotope in the spectrum of Ni^{2+} and the hyperfine splitting constant A^{61} found to be $(8.3 \pm 0.4) \times 10^{-4}$ cm^{-1}. X irradiation of cobalt-containing crystals results in the formation of Co^{1+} (isoelectronic with Ni^{2+}). The hyperfine splitting constant A^{59} is $(54.0 \pm 0.2) \times 10^{-4}$ cm^{-1}. Comparison between A^{59} and A^{61} yields a value of 0.30 ± 0.02 nm for the nuclear moment of Ni^{61}. (auth)

24890

DECAYS OF Rh^{106} AND Ag^{106}. R. L. Robinson (Oak Ridge National Lab., Tenn.), F. K. McGowan and W. G. Smith. Phys. Rev. 119, 1692-1701(1960) Sept. 1.

The gamma-ray spectra of 30-sec Rh^{106} and 8.3-day Ag^{106}, which both decay to Pd^{106}, were studied with scintillation spectrometers. Three γ-γ angular correlations were also measured. The results are consistent with the following level scheme for Pd^{106}: 0.513(2+), 1.131(2+), 1.137(0+), 1.360 or 1.213, 1.563(2+), 1.73(2 or 3), 1.84, 1.88, 1.94(3− or 4+), 2.01, 2.052(4+), 2.09(3), 2.28, 2.305 (3 or 4), 2.352(4+), 2.46, 2.62, 2.764(5−), 2.87, and 3.08 Mev. The transition between the first and second 2+ levels was found to consist primarily of E2 radiation. The branching ratio obtained for the cascade to crossover γ rays from the second 2+ level is 2.1 ± 0.3. This ratio combined with Coulomb excitation data of Stelson and McGowan gives a value of 1.0 ± 0.3 for the ratio $B(E2, 2' \rightarrow 2)/B(E2, 2 \rightarrow 0)$. (auth)

24891

REACTION $C^{14}(p,n)N^{14}$. J. K. Bair, R. D. Edge, and H. B. Willard (Oak Ridge National Lab., Tenn.). Phys. Rev. 119, 1948-52(1960) Sept. 15.

The reaction $C^{14}(p,n)N^{14}$ was studied up to 5 Mev bombarding proton energy with good resolution using targets of high isotopic enrichment. Levels previously unseen in this reaction were found at proton energies of 3.19 (Γ = 6 kev), 3.38 (Γ = 24 kev), 3.63 (Γ = 13 kev), 3.89 (Γ = 35 kev), 4.19 (Γ = 112 kev), 4.24 (Γ = 27 kev), 4.61 (Γ = 140 kev), and 4.93 Mev (Γ = 106 kev). Excitation curves at three angles in the region of 2.9 Mev proton energy show the effect of the previously known $J = \frac{5}{2}^-$ (Γ = 80 kev) resonance interfering with a level of opposite parity. Effects of the nearby $J = \frac{7}{2}^-$ (Γ = 40 kev) level were not seen, presumably due to the low penetrability of the outgoing F-wave neutron. The thresholds for the second and third neutron groups were investigated using a lithium iodide detector. A new threshold, that for production of the third neutron group, was measured to be 4.910 ± 0.008 Mev in agreement with the known energy of the second excited state in N^{14}. (auth)

24892

STUDIES OF DECAY SCHEMES IN THE OSMIUM-IRIDIUM REGION. II. DECAY OF 12-DAY Ir^{190}. W. R. Kane (Harvard Univ., Cambridge, Mass.), G. T. Emery, G. Scharff-Goldhaber, and M. McKeown. Phys. Rev. 119, 1953-69(1960) Sept. 15.

Spectra of the gamma rays and internal conversion electrons emitted in the decay of 12-day Ir^{190} were studied in detail. Internal conversion spectra were obtained with the aid of double-focusing and intermediate-image β spectrometers and a permanent-magnet spectrograph. Gamma spectra were obtained by means of photoelectric conversion, employing a double-focusing spectrometer, and by scintillation techniques. These measurements of the energies and relative intensities of γ rays and internal conversion electrons give internal conversion coefficients for a number of transitions. These data, coupled with coincidence studies of γ rays, support the level scheme reported by Nielsen et al. for Os^{190} and establish new, odd-parity levels at 1384, 1568, and 1876 kev. An upper limit of 2×10^{-5} is set on positron branching in the decay of Ir^{190}. Relative electron capture transition probabilities for the decay of Ir^{190} to Os^{190} and ratios of reduced transition probabilities for electromagnetic transitions from a number of levels of Os^{190} follow from these results. They are compared with the predictions of the strong-coupling model and the asymmetric rotor model. The half life of Ir^{190} was found to be 12.3 ± 0.4 days. Even-A iridium-osmium total disintegration energies were found to rise substantially above the values predicted by semiempirical mass formulas; this suggested a possible effect of the change in the nuclear deformation in this region. (auth)

24893

9.0-Mev GAMMA-EMITTING LEVEL IN C^{12}. D. E. Alburger and R. E. Pixley (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 119, 1970-4(1960) Sept. 15.

An energy level in C^{12} at 9.0 ± 0.1 Mev was detected by means of (p,γ,γ) coincidence measurements on the $B^{10}(He^3,p)C^{12}$ reaction at $E_{He^3} = 2.2$ Mev. This state decays by a γ-γ cascade through the 4.43 Mev first excited state. An upper limit of 5% is placed on the ground-state γ transition. The intensity of the proton group leading to the 9.0 Mev state (followed by γ emission) is (0.21 ± 0.07)% relative to the proton branch to the 4.43 Mev level. Gamma branches from the 15.10 and 12.78 Mev states in C^{12} to the 4.43 Mev level were determined as (4 ± 1)% and (20 ± 7)%, respectively, relative to the corresponding ground-state transitions. The radiations from the 9.0 Mev level prevented a sensitive search from being made for the 3.2 Mev γ radiation from the 7.66 Mev level in C^{12} by means of this reaction. (auth)

24894

CLASSICAL ANALYSIS OF THE REACTION $Be^9(Li^7,Li^8)Be^8$. Samuel K. Allison (Univ. of Chicago). Phys. Rev. 119, 1975-81(1960) Sept. 15.

The mechanism of the reaction $Be^9(Li^7,Li^8)Be^8$, Q = 0.36 Mev, from which the angular distribution of Li^8 was measured by Norbeck, Blair, Pinsonneault, and Gerbracht, is analyzed from a classical viewpoint. The reaction is one of neutron pickup by the Li^7, and it is assumed that due to the low reaction energy and relatively low mass of the neutron the Li^7 and Be^9 are not unrecognizably perturbed from the classical hyperbolic orbits they would follow under Coulomb repulsion. For the data taken at 2 Mev Li^7 bombarding energy, it is noted that the blurring of the classical trajectories due to diffraction is about 37% in the angle of deviation. Comparison of the measured cross sections per steradian for Li^8 formation with those calculated from Rutherford's formula shows that 1 in 10^6 passing Li^7 nuclei can capture a neutron from Be^9 in encounters in which the perinuclear distance is as great as $(3.0 \pm 0.55) \times 10^{-12}$ cm. The rate of radial attenuation of the probability of finding the Be^9 neutron in unit volume is determined from the angular distribution of Li^8 by the use of the classical equation for the perinuclear separation as a function of angular deviation. In the region $(1.5 < r < 3) \times 10^{-12}$ cm it is consistent with the slope of the function $nr^{-2} \exp(-2\beta r)$ with $\beta = (2.1 \pm 0.5) \times 10^{12}$ cm^{-1}. The theoretical value for a neutron bound to a Be^8 structure by $W_n = 1.63$ Mev is $(2_\mu W_n)^{1/2}/\hbar$ or 2.6×10^{12} cm^{-1}. It is shown that the extraordinarily low (n,γ) cross section for Li^7 determined by Imhoff, Vaughn, Johnson, and Walt cannot be used here to describe the capture. Using a plausible cross section of 5×10^{-25} cm^2, the value of n in the specified region is 1.3×10^{13} cm^{-1}, giving, for instance, the absolute value of neutron probability per cm^3 at 2.0×10^{-12} cm radius as 6.2×10^{32} cm^{-3}. The function $nr^{-2} \exp(-2\beta r)$ must join on to one less steep at a radius $\geq 8 \times 10^{-13}$ cm, or the neutron probability integrated over all space becomes greater than unity. (auth)

24895

ELASTIC SCATTERING OF FAST NEUTRONS BY TRITIUM AND He^3. J. D. Seagrave, L. Cranberg, and J. E. Simmons (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 119, 1981-91(1960) Sept. 15.

Differential cross sections were obtained for the elastic scattering of neutrons by tritium and by He^3 at $E_n = 1.0$, 2.0, 3.5, and 6.0 Mev over the angular range 27 to 161° in the c.m. system. The Los Alamos large Van de Graaff accelerator and pulsed-beam time-of-flight facility were employed. The scattering samples were contained in small thin-walled stainless steel spheres. One-third mole of He^3 was contained at 5000 psi and one-half mole of tritium was prepared in the form of CaT_2. Absolute cross sections were determined from a comparison with the scattering from a thin shell of CH_2 at each energy, together with calibration of the relative sensitivity of the detector as a function of energy by the known forward yield of the $T(p,n)He^3$ reaction. The angular distributions for n-T scattering were in excellent agreement with the calculations of Bransden, Robertson, and Swan based on a Serber exchange force. The n-He^3 measurements favored qualitatively the Serber rather than the symmetrical exchange force used in the calculations, but the agreement was poorer than that obtained for n-T scattering. The polarization of elastically scattered 1 Mev neutrons was found to be less than 5% for both samples, unlike the strong polarization observed in n-He^4 scattering. (auth)

24896

HEAVY ISOTOPE ABUNDANCES IN MIKE THERMONUCLEAR DEVICE. H. Diamond (Argonne National Lab., Ill.), P. R. Fields, A. Ghioroso, S. G. Thompson, C. I. Browne, H. L. Smith, et. al. Phys. Rev. 119, 2000-4 (1960) Sept. 15.

The Nov. 1, 1952, thermonuclear explosion ("Mike") produced all of the uranium isotopes U^{239}, U^{240}, ... U^{255} through multiple neutron capture by U^{238}. The long-lived products of successive β decays from these isotopes were measured mass spectrometrically and radiometrically. The logarithms of the abundances decline smoothly with increasing mass number; the even-mass abundances slightly exceed the geometric mean of adjacent odd-mass abundances. Some nuclear properties of neutron-rich heavy nuclides, not subject to ordinary investigation, are inferred. (auth)

24897

EVIDENCE FOR 0^+ AND 1^- LEVELS IN U^{234} POPULATED IN THE ONE-MINUTE BETA DECAY OF Pa^{234}. G. T. Wood (Univ. of Copenhagen). Phys. Rev. 119, 2004-9 (1960) Sept. 15.

A directional correlation measurement was performed on the 250 kev vs. (751 + 795) kev composite cascade in U^{234} following the 24-day β decay of Th^{234} and the subsequent one-minute β decay of Pa^{234}. The "770" kev (751 + 795 kev) composite photopeak spectrum coincident with the 250 kev γ ray was displayed on a multichannel pulse-height analyzer for different positions of the scintillation counters. From these spectra the directional correlations between the 250 kev γ ray and the lower and upper sides of the 770 kev composite line were measured. The results together with other measurements are consistent with assignments of multipolarity E1 to the 250, 751, and 795 kev γ rays and spin and parity assignments $0^+-1^--2^+$ and $0^+-1^--0^+$ to the levels involved in the 250–751 kev and 250–795 kev γ-γ cascades, respectively. Thus new levels are proposed at 795 and 1046 kev with spin and parity 1^- and 0^+, respectively. (auth)

24898

ELASTIC SCATTERING OF HEAVY IONS BY GOLD AND BISMUTH. H. L. Reynolds (Univ. of California, Livermore), E. Goldberg, and D. D. Kerlee. Phys. Rev. 119, 2009-16(1960) Sept. 15.

The angular distributions of C^{12}, N^{14}, O^{16}, and Ne^{20} elastically scattered by Au^{197} and Bi^{209} were measured at laboratory energies of approximately 10.4 Mev per nucleon. The elastically scattered ions were recorded in photographic emulsions at laboratory angles from 19 to 175°. In general, measurements were extended only to angles where the ratio of the cross section to the Coulomb cross section, σ/σ_c, was greater than 0.1. In one case the measurement was extended to a region where $\sigma/\sigma_c \leq 1.4 \times 10^{-4}$. The cross sections all exhibited a behavior similar to that previously reported for C^{12} on Au^{197}. An oscillation in the cross-section ratio occurring at smaller angles than the 20 to 30% rise and sudden drop was observed. Excellent agreement was obtained with the Blair "sharp-cutoff" calculations for values of $\sigma/\sigma_c > 0.2$. Nuclear interaction distances calculated by fitting the sharp-cutoff calculations are consistent with $r_0 = 1.46$ fermis, where $R = r_0(A_1^{1/3} + A_2^{1/3})$. No striking distinction can be made regarding the surface characteristics of the four projecticles or the two targets. (auth)

24899

RATIO OF ASYMMETRIC TO SYMMETRIC FISSION OF Pu^{239} AND Pu^{241} AS A FUNCTION OF NEUTRON ENERGY. R. B. Regier, W. H. Burgus, R. L. Tromp, and B. H. Sorensen (Phillips Petroleum Co., Atomic Energy Div., Idaho Falls, Idaho). Phys. Rev. 119, 2017-20(1960) Sept. 15.

Further radiochemical experiments were carried out to test the theoretical suggestion that in low-energy neutron-induced fission, the asymmetric to symmetric fission ratio should depend on the spin of the fissioning nucleus. In the present work two kinds of experiments were done. In the first, with both Pu^{239} and Pu^{241}, comparisons were made of the asymmetric/symmetric yield ratios for thermal fission with the corresponding ratios for gross resonance fission with epi-Sm neutrons. In the second kind, monoenergetic neutrons were employed to study variations of Pu^{239} fission yields with neutron energy over the 0.297 ev resonance. If the assumption is made that spin difference is the principal cause of change in the asymmetric/symmetric ratio in this energy region, the results indicate that this ratio differs by a factor of at least 5.3 between the two spin states of Pu^{239}. This is the largest effect of this kind observed to date. (auth)

24900

NUCLEAR STRUCTURE EFFECTS IN Cs^{133}. M. K. Ramaswamy (Ohio State Univ., Columbus). Phys. Rev. 119, 2021(1960) Sept. 15.

The 79 kev transition in Cs^{133}, which is known to be l-forbidden ($\Delta l = 2$) magnetic dipole (M1), was analyzed for penetration effects suggested by Church and Weneser. A value of 6.5 ± 2.6 was found for λ, the ratio of the matrix element due to penetration of the atomic electron into the nucleus and the matrix element due to M1 gamma emission. This value of λ is to be compared with the range 5 to 10 obtained by Church and Weneser for l-forbidden ($\Delta l = 2$) transitions using empirical γ matrix elements and single-particle wave functions to evaluate the electron matrix element. (auth)

24901

ATOMIC-BEAM MEASUREMENT OF THE HYPERFINE STRUCTURE AND NUCLEAR MOMENTS OF IODINE-131. Edgar Lipworth, Hugh L. Garvin, and Thomas M. Green (Univ. of California, Berkeley). Phys. Rev. 119, 2022-5 (1960) Sept. 15.

The nuclear magnetic dipole and nuclear electric quadrupole interaction constants a and b were measured in 8-day I^{131} by an atomic beam magnetic resonance experiment. The results were $a = 575.903 \pm 0.007$ Mc/sec, $b = 578.866 \pm 0.075$ Mc/sec. The zero-field hyperfine splittings computed from these values of a and b were $\Delta\nu(5,4) = 3292.99 \pm 0.09$ Mc/sec, $\Delta\nu(4,3) = 2138.22 \pm 0.05$ Mc/sec, $\Delta\nu(3,2) = 1314.24 \pm 0.07$ Mc/sec. The nuclear magnetic dipole moment and nuclear electric quadrupole moment were calculated as $\mu_{131} = 2.738 \pm 0.001$ nm, $Q_{131} = -0.41 \pm 0.01 \times 10^{-24}$ cm^2. The value of μ_{131} obtained differed slightly from that obtained by other workers, whereas the value of Q confirmed an earlier measurement made by a different method. (auth)

24902

LEVEL STRUCTURE OF N^{14}. J. K. Bair, H. O. Cohn, and H. B. Willard (Oak Ridge National Lab., Tenn.). Phys. Rev. 119, 2026-9(1960) Sept. 15.

Yields and angular distributions of the γ rays from the first and second levels in C^{13} following excitation by inelastic proton scattering were measured. Levels were observed at bombarding proton energies 3.80 (Γ = 100 kev), 4.1 (Γ = 150 kev), 4.14, and 4.52 Mev (Γ = 150 kev). The first three levels resulted in excitation of the first excited state and the last in excitation mainly of the second excited state of C^{13}. N^{14} excitation energies corresponding to these levels are 11.07, 11.35, 11.39, and 11.74 Mev. Possible spin and parity assignments were made on the basis of the γ angular distribution of the 4.52 Mev level. The $C^{13}(p,n)N^{13}$ neutron yield was rerun; this yielded better values of the resonant energies. Neutron angular distributions are given for several bombarding proton energies. (auth)

24903

MÖSSBAUER EFFECT IN Fe^{57} AT VERY LOW TEMPERATURES. J. G. Dash, R. D. Taylor, P. P. Craig, D. E. Nagle, D. R. F. Cochran, and W. E. Keller (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. Letters 5, 152-4 (1960) Aug. 15.

The preparation of a 10 mc Co^{57} source in natural iron metal is described. The source was placed in an adiabatic demagnetization cryostat fitted with thin windows of Mylar plastic and Beryllium metal. The 14.4-kev radiation was filtered by an oscillating resonant absorber of approximately 2 mg/cm^2 Fe^{57} plated on a 0.1 mil nickel foil. Intensities were measured alternately in each direction over the same length of absorber travel. The absorption coefficients were examined by measuring the resonant γ-ray transmission from the source at room temperature by the technique of Doppler-shifting the source relative to the cold absorber. Larger asymmetries are produced by cooling the source instead of the absorber, due to the magnetic moment difference between Co^{57} and ground-state Fe^{57}. Calculations were made which predicted a larger over-all effect than the scheme of cooling an absorber; accordingly, the experiment was conducted using a cold source and absorber at room temperature. (B.O.G.)

24904

SOURCE OF POLARIZED DEUTERONS AND THE VERIFICATION OF ALIGNMENT WITH THE $T(d,n)He^4$ REACTION. E. Baumgartner, L. Brown, P. Huber, H. Rudin, and H. R. Striebel (Univ. of Basel). Phys. Rev. Letters 5, 154-6(1960) Aug. 15.

An ion source for polarized deuterons was constructed, and the $T(d,n)He^4$ reaction was employed to confirm the alignment of the source. The course of the particles through the device is described. The population ratio G of spin state O to the sum of the states +1 and –1 is given for the measured distribution in graphical form. (B.O.G.)

24905

HYPERFINE STRUCTURE IN THE GROUND STATE OF THE STABLE ISOTOPES OF EUROPIUM. P. G. H. Sandars and G. K. Woodgate (Univ. of Oxford). Proc. Roy. Soc. (London), A 257, 269-76(1960) Sept. 6.

The hyperfine structure of the ground states $4f^7 6s^2\,{}^8S_{1/2}$ of Eu^{151} and Eu^{153} were measured by the method of magnetic resonance in an atomic beam. The sign of the hyperfine structure and the value of g_J were measured. The results are $g_J = 1.9935 \pm 0.0003$; $A(151) = -20.0523 \pm 0.0002$ Mc/s, $A(153) = -8.8532 \pm 0.0002$ Mc/s; and $B(151) = -0.7012 \pm 0.0035$ Mc/s, $B(153) = -1.7852 \pm 0.0035$ Mc/s. These results disagree with the values expected for the pure ${}^8S_{1/2}$ state formed from a half-filled shell of f-electrons. Calculations on the basis of admixture of higher states of the configuration by spin-orbit coupling account for the discrepancy in g_J but do not explain the values of the hyperfine structure constants A and B. Further theoretical work is in progress. (auth)

24906

THE NUCLEAR MAGNETIC DIPOLE MOMENTS OF THE STABLE ISOTOPES OF EUROPIUM AND THE HYPERFINE STRUCTURE ANOMALY. F. M. Pichanick, P. G. H. Sandars, and G. K. Woodgate (Univ. of Oxford). Proc. Roy. Soc. (London), A 257, 277-82(1960) Sept. 6.

The nuclear magnetic dipole moment of Eu^{151} and the ratio of the moments of Eu^{151} and Eu^{153} were measured by the new method of resonance in three loops in a short atomic beam. The results are $\mu({}^{151}Eu) = 3.419 \pm 0.004$ nm, and $\mu({}^{151}Eu)/\mu({}^{153}Eu) = 2.2686 \pm 0.0015$. The results, taken to gether with the ratio of the hyperfine structures of europium, give a hyperfine structure anomaly of $(1.0 \pm 0.23)\%$. A theoretical value of the anomaly is estimated. (auth)

24907

NUCLEAR REACTIONS IN COLD HYDROGEN. MESON CATALYSIS. Ya. B. Zel'dovich and S. S. Gershtein. Uspekhi Fiz. Nauk 71, 581-630(1960) Aug. (In Russian)

A systematic review is presented of the experimental and theoretical aspects of μ-catalysis in cold hydrogen. The mechanism was studied and evaluations were made of the probabilities of meso-molecule formation. Meso-molecular processes in hydrogen, the adiabatic approximation and its correction, levels of meso-molecules, transitions of μ mesons from light isotopes to the heavy, scattering of mesic atoms on nuclei, and transitions between meso-molecular levels are studied as well as nuclear reactions in meso-molecules, reaction constants, penetration of nuclei through the meso-molecule barrier, and the efficiency of nuclear reaction catalysis by mesons. 44 references. (R.V.J.)

24908

THE HALF LIVES OF SOME POSITRON EMITTERS WITH SUPERPERMITTED TRANSITIONS. J. Jänecke (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Naturforsch. 15a, 593-600(1960) July. (In German)

The half lives of the superallowed β^+ emitters (Li^8, N^{13}, O^{15}, F^{17}, Ne^{19}, Al^{25}, P^{29}, S^{31}, Cl^{33}, Ar^{35}, Sc^{41}, Ti^{43}, Al^{26m}, Cl^{34}, K^{38m}, and Sc^{42}) were measured with high precision. There are deviations from the known values, especially for Sc^{41}. A plot of log $T_{1/2}$ versus log $(\bar{Z}/A^{1/3})$ for the mirror transitions and the $0^+ \rightarrow 0^+$ transitions of the nuclei with $A = 4n + 2$ contains breaks and irregularities and therefore shows the effect of shell structure. (auth)

24909

PARITY PURITY OF THE NUCLEAR STATE IN Rb^{85}. Th. Mayer-Kuckuk and S. A. A. Zaidi (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Physik 159, 369-72 (1960). (In German)

Nuclear γ radiation must be circularly polarized if parity conservation does not hold strictly in nuclear states. From a polarization measurement of the 513-kev γ line in Rb^{85}, an upper limit for the relative amplitude of the irregular wave function $F \leqq 5.5 \times 10^{-6}$ was obtained. (auth)

24910

THE DECAY OF Gd^{153}. Heinrich Leutz (Universität, Heidelberg, Ger.). Z. Physik 159, 462-77(1960). (In German)

The electron-capture decay of Gd^{153} was studied by mounting the radioactive source in three different ways. These were outside, in the center, or built in the lattice of a NaI(Tl) crystal. The $P_{L+M+\ldots}/P_K$ capture ratio was measured for the disintegration into the 97.5 or 103 kev level and into the 172.5 level of Eu^{153} as 0.34 ± 0.02 and 0.85 ± 0.3, respectively. These results were used to determine the disintegration energy of Gd^{153}, which, for the two levels, is 279.5 ± 8 kev and 269^{+26}_{-16} kev. Moreover, branching ratios, log ft-values, and conversion coefficients were determined. (auth)

24911

ANGULAR DISTRIBUTION OF PROTONS FROM THE $C^{12}(d,p)C^{13}$ REACTION WITH 5–13 Mev DEUTERONS. N. I. Zaika, O. F. Nemets, and M. A. Tserineo. Zhur. Ekspt'. i Teoret. Fiz. 39, 3-6(1960) July.

The angular distributions of protons corresponding to the ground state of C^{13} were measured for five deuteron energies in the energy interval 5 to 13 Mev and also of protons corresponding to the three lower excited states for deuteron energies of 13.3 and 12.1 Mev. The parities and possible spins of the states were determined. It is shown that with decrease of the energy non-stripping reactions become more important. (auth)

24912

DECAY OF Er^{161}. I. S. Dneprovskiĭ, L. Nemet, and L. K. Peker (Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Zhur. Ekspt'. i Teoret. Fiz. 39, 13-15(1960) July. (In Russian)

The radiation emitted in the decay of Er^{161} was studied with a scintillation spectrometer and a double focusing β spectrometer. On the basis of previously obtained data and the data obtained in the present work, a decay scheme is proposed. (auth)

24913

ON THE LEVEL SCHEME OF Ta^{181}. G. A. Vartapetyan and A. G. Khudaverdyan (Inst. of Physics, Academy of Sciences, Armenian SSS). Zhur. Eksptl'. i Teoret. Fiz. 39, 25-6(1960) July. (In Russian)

By the β-γ coincidence technique it is shown that a 137 kev transition between the 619 and 482 kev levels ($T_{1/2}$ = 10^{-8} sec) does not exist, whereas some new γ transitions at 619, 480, and 345 kev were detected. The period of the 619 kev level is less than 10^{-9} sec. (auth)

24914

MEASUREMENT OF THE ENERGY OF α-PARTICLES FROM SOME EMITTERS. A. A. Vorob'ev, A. P. Komar, V. A. Korolev (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 39, 70-2(1960) July. (In Russian)

Precise measurements of the energies of α particles from At^{217}, Fr^{221}, Po^{213}, U^{235}, and U^{238} were made with an ionization α spectrometer. (auth)

24915

POSITION OF THE GIANT RESONANCE IN THE DIPOLE ABSORPTION OF γ-QUANTA BY ATOMIC NUCLEI. V. G. Neudachin, V. G. Shevchenko, and N. P. Yudin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 39, 108-11(1960) July. (In Russian)

The giant resonance curves for a number of intermediate nuclei (Ca^{40}, V^{51}, Ni^{58}, $Cu^{63,65}$) are calculated by the shell model. It is shown that if spectroscopic data on the lower levels are employed, the shell calculations yield in a natural manner the correct position of the giant resonance. (auth)

24916

ON THE INFLUENCE OF PAIR CORRELATION OF NUCLEONS ON THE PROBABILITIES OF ELECTROMAGNETIC TRANSITIONS IN NUCLEI. Yu. T. Grin. Zhur. Eksptl'. i Teoret. Fiz. 39, 138-40(1960) July. (In Russian)

The influence of pair correlation of nucleons on the probabilities of electromagnetic transitions in deformed nuclei was considered. It is shown that the quasi-one-particle electric multiple transitions in the neighborhood of the Fermi surface are forbidden by a factor $\sim A^{-2/3}$ compared to the one-particle transitions. (auth)

24917

THEORY OF α-DECAY OF NONSPHERICAL NUCLEI. V. G. Nosov (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 39, 141-8 (1960) July. (In Russian)

A consistent theory of α decay of nonspherical nuclei based on the corresponding generalization of the quasi-classical quantum mechanical approximation is developed. Formulas are derived for the relative intensities of α fine structure lines and also for the α-decay constant and the angular distribution of α particles emitted by oriented nuclei. A new method is proposed for measuring quadrupole polarization of oriented nuclei. (auth)

24918

HYPERFINE γ-RAY STRUCTURE INDUCED BY QUADRUPOLE INTERACTION IN CRYSTALLINE LATTICE. N. N. Delyagin, V. S. Shpinel, V. A. Bryukhanov, and B. Zvenglinskii (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 39, 220-2(1960) July. (In Russian)

The hyperfine structure of Sn^{119} induced by the quadrupole moment interaction with the internal electric field of a tin crystal was studied. The distance $\Delta = (eQ/2\partial^2 v/dz^2)$ between the hyperfine structure components at 23.8 kev is $(1.15 \pm 0.25) \times 10^{-7}$ ev. The magnitude of the quadrupole moment was not determined owing to an unknown gradient in the electric field of the crystal. (R.V.J.)

24919

THE DETERMINATION OF THE HALF-LIFE OF U^{238} BY ABSOLUTE COUNTING OF α PARTICLES IN A 4 π-LIQUID SCINTILLATION COUNTER. J. Steyn and F. W. E. Strelow (Council of Scientific and Industrial Research, Pretoria). p.155-61 of "Metrology of Radionuclides. Proceedings of a Symposium, Vienna, 14-16 October, 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The specific activity of natural uranium was determined by liquid scintillation α counting. Uranium was extracted from its decay products by methyl isobutyl ketone, and samples of this solution were added directly to the liquid scintillator. A quantitative investigation was made of the separation of uranium from thorium by the extraction method employed. Assuming that U^{238} and U^{234} were in equilibrium and correcting for the presence of U^{235}, the specific activity and the half life of the isotope U^{238} were calculated. (auth)

24920

SELF-ABSORPTION STUDIES WITH A 4 π β-PROPORTIONAL FLOW COUNTER. L. Yaffe and J. B. Fishman (McGill Univ., Montreal). p.185-99 of "Metrology of Radionuclides. Proceedings of a Symposium, Vienna, 14-16 October, 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Self-absorption studies of β emitters were made by means of the techniques outlined by Pate and Yaffe [Can. J. Chem. 34, 265 (1956)]. Volatile compounds of H^3, Ni^{63}, C^{14}, Co^{60}, Hg^{203}, As^{77}, and P^{32} (E_{max} ranging from 0.018 to 1.7 Mev) were distilled onto thin VYNS mounts and the self-absorption characteristics determined. An empirically determined series of curves relating E_{max}, source thickness, and self-absorption is given. The self-absorption data were subjected to a theoretical analysis for counters of small angle and 4 π geometry. The experimentally determined self-absorption curves for 4 π geometry lie in between the theoretical small angles and 4 π geometry curves. (auth)

24921

THE ABSOLUTE COUNTING OF NUCLIDES DECAYING BY β EMISSION ONLY. P. J. Campion, J. G. V. Taylor, and J. S. Merritt (Atomic Energy of Canada, Ltd., Chalk River, Ont.). p.227-44 of "Metrology of Radionuclides. Proceedings of a Symposium, Vienna, 14-16 October, 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Using the 4 π β-γ coincidence technique, self-absorption was measured as a function of β-ray end-point energy for a constant mean source superficial density of 2 $\mu g/cm^2$ and for a number of source-preparation techniques. The self-absorption varied from a few tenths of 1% at β end-point energies of 1.39 Mev to about 20 to 40% at 0.086 Mev, depending on the source-preparation techniques employed. A plot of these results can be used, with caution, to estimate the self-absorption of a nuclide that decays by β emission only and which is therefore not amenable to the coincidence technique. The possibility of combining with the β activity a suitable β-γ nuclide was investigated. It was preferable to incorporate both activities into the same molecular structure in order to avoid any differential effects in the crystallization process as the source was dried. The over-all efficiency of the β detector for such a source of mixed activities was measured with respect to the β-γ nuclide using the 4 π β-γ coincidence technique. This efficiency was largely determined by the self-absorption in the source material and was also a measure of the efficiency of the β detector with respect to the β activity. A correction had to be made to allow for any difference in β spectra. A number of sources of mixed β and β-γ activities were prepared in which the amount of inactive carrier, and hence self-absorption, was varied. The β-detector efficiency was measured with respect to the β-γ nuclide for each source, and if this was a short-lived activity it was allowed to decay to a negligible level. The counting rate of the β activity was then measured in the same detector, and this rate was plotted against the corresponding efficiency for the β-γ nuclide. This plot yielded over a considerable efficiency range a straight line which could be extrapolated to 100% efficiency to obtain the absolute counting rate of the β activity. Br^{82} is suggested as one convenient β-γ nuclide. The method can be extended to the use of long-lived nuclides such as Co^{60} thus giving a greater range of β end-point energies. In this case the contribution of the β-γ nuclide to the total β counting rate is determined from the efficiency and the amount of the β-γ activity added. This contribution is then subtracted to give the β counting rate due to the β activity. The extrapolation technique was verified experimentally for a number of pairs of suitable β-γ nuclides in which the efficiency of the β detector could be measured with respect to both activities. Experimental results are shown and compared with theoretical models. In addition a sample of S^{35} was standardized by this method using $Co^{60}S^{35}O_4$ and $Lu_2^{177}(S^{35}O_4)_3$, and the results were in good agreement with those obtained by differential gas counting of $S^{35}O_2$, and by 4 π β counting using a self-absorption correction taken from the above mentioned curve. Experience suggests that provided a β-γ nuclide can be found whose β end-point energy is within a factor of roughly two of that of the β emitter the latter can be standardized to an accuracy of 1 to 3%. (auth)

Particle Accelerators

24922 ANL-6152
Argonne National Lab., Ill.
PARTICLE ACCELERATOR DIVISION SUMMARY REPORT [FOR] MAY 1959 THROUGH MARCH 1960. 57p. Contract W-31-109-eng-38. OTS.

The procurement status of the ring magnet power supply is given. The effects of the magnet voltage regulation method on the power requirements, the r-f accelerating voltage, and the number of accelerating gaps are summarized. Harmonics of the power supply are calculated. Correlation of synchrotron oscillation frequencies to harmonic flux densities is made. The effect of duration Δt of flat topping on the motor and flywheel requirements under different conditions is calculated. Arc-back expectancies with 144 and 192 rectifiers for the power supply are given. The inner and outer vacuum chambers of the ring magnet are discussed. Spacemetal will be used for the inner vacuum chamber, because of its better outgassing performance. Outgassing measurements were made on AF-31 nitrile-phenolic bonding film. Theoretical studies are summarized. The radiofrequency system, injection system, ring magnet coil, and auxiliary calculations are discussed. (For preceding period see ANL-6032.) (W.D.M.)

24923 MURA-578
Midwestern Universities Research Assn., Madison, Wis.
CONSTANT-AREA R-F BUCKETS IN THE IBM-704 PROGRAMME TTT. Robert A. Dory. July 1, 1960. 8p. Contract AT(11-1)-384. OTS.

A method is provided for using the polynomial frequency of TTT when r-f buckets of constant area are to be considered. The polynomial for the example $\Gamma = \frac{1}{2}$ is given. (W.D.M.)

24924 MURA-583
Midwestern Universities Research Assn., Madison, Wis.
INTEGRAL SCALING MAGNETIC FIELD USING DISTRIBUTED WINDINGS. S. C. Snowdon. Aug. 8, 1960. 19p. Contract AT(11-1)-384. OTS.

The magnetic field of a spiral sector FFAG magnetic guide possessing integral scaling is calculated with the aid of scalar functions representing the fields and the current sources. In particular, the spiral sector magnet considered possesses equally spaced radial cuts into which r-f cavities may be inserted. The distributed pole face windings are located in spiral slots and are connected along the radial cuts. (auth)

24925 TID-6204
Stevens Inst. of Tech., Hoboken, N. J.
THE CONSTRUCTION AND STUDY OF A HIGH FIELD PLASMA BETATRON ACCELERATOR. Final Report [for] May 1, 1959–April 30, 1960. K. C. Rogers and D. Finkelstein. 68p. Contract AT(30-1)-2410 and AT(30-1)-1921. (SIT-P9-6/60; NYO-9101). OTS.

With this are bound papers: PLASMA BETATRON ACCELERATORS. K. C. Rogers and D. Finkelstein; Stevens Inst. of Tech., Hoboken, N. J. and Signal Corps [Engineering] Labs., Fort Monmouth, N. J. A HIGH EFFICIENCY CAPACITOR BANK STUDY. K. C. Rogers, D. Finkelstein, L. Ferrari, I. Mansfield, and G. Brucker. (NYO-2378).

The Megatron (mega-gauss betatron), for accelerating electrons and positive ions in opposite directions within an ionized gas, is described. The machine is designed to create a 1000-amp beam of 150-Mev electrons. A low-inductance 10^5-joule capacitor bank is charged to 50 kv, then discharged into the field coil which surrounds a plasma-filled torus accelerating the charged particles to peak energy in 6 μsec. The design has some novel features such as the use of a single one-turn coil to provide the entire accelerating and guide fields, guiding magnetic fields and accelerating electric fields larger than those used in present accelerators, and plasma injection to get the necessary number of particles into the place where they will be accelerated. The 100,000-joule capacitor bank is designed to deliver capacitively stored energy efficiently and rapidly into low-inductance loads. The bank is described in detail and the modifications necessary to increase the energy storage to 10^6 joules are outlined. (See also AD-233991.) (W.D.M.)

24926 UCRL-9237
California. Univ., Berkeley. Lawrence Radiation Lab.
THE USE OF FILAMENTARY TARGETS TO PRODUCE PROLONGED SECONDARY-PARTICLE BEAMS IN THE BEVATRON. Harry G. Heard. Mar. 1960. 12p. Contract W-7405-eng-48. OTS.

The foil technique for producing secondary-particle beams in a proton synchrotron is extended. Filamentary targets are described that are shown to produce secondary-particle beams having almost arbitrary time duration and uniform intensity. The physical limitations imposed by available materials are discussed. (auth)

24927 AEC-tr-4175
THE 28 MEGAVOLT ELECTRON ACCELERATOR PROJECT OF THE SACLAY CENTER OF NUCLEAR STUDIES. H. Leboutet, [E.] Picard, and Vastel. Translated for Argonne National Lab. from Onde élec. 37, 28-35(1957). 19p. JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 16776.

24928
MODELLING OF THE PHASE MOTION OF PARTICLES IN

A SYNCHROPHASOTRON BY MEANS OF A SYSTEM PROVIDING FOR INERTIA SYNCHRONIZATION OF FREQUENCY MODULATED GENERATOR. A. A. Vasil'ev. Doklady Akad. Nauk S.S.S.R. 133, 345-8(1960) July 11. (In Russian)

Analog techniques were applied in synchronizing a frequency-modulated generator. The described modeling system can be directly connected to a device inducing the particle acceleration or it may be used in investigating the particle-energy increment effects on phase oscillations. (R.V.J.)

24929

BALANCED ACCELERATION AND DEFLECTION ELECTROSTATIC FOCUSING. P. A. Sturrock (Stanford Univ., Calif.). J. Electronics and Control (1), 8, 267-72(1960) Apr. (In English)

Periodic focusing systems normally have the following property: as the strength of the focusing field is increased from zero, the system is initially stable but subsequently passes through alternate bands of stability and instability, of which the former are normally the narrower. In consequence, operation of a given system must usually be restricted to the first band. A suitable combination of acceleration focusing and deflection focusing leads to a model for a periodic electrostatic focusing system that is free from instabilities. Convenient electrode structures are shown which will approximate the required field; the resulting system should have only narrow bands of instability. Such structures are similar to the Slalom configuration with the important difference being that the beam travels on one side only of the central electrodes. This scheme has the following characteristics that should make it suitable for incorporation in a tape-helix traveling-wave tube: the beam velocity varies in such a way that electrons spend more time between the central electrodes, and the beam thickness varies in such a way that the beam is thinnest where it passes the central electrodes. (auth)

24930

THE UTRECHT 850 kv CASCADE GENERATOR. I. BEAM DEFLECTION AND ENERGY CONTROL. C. M. Braams and P. B. Smith (Rijksuniversiteit, Utrecht). Nuclear Instr. & Methods 8, 27-39(1960) July. (In English)

The beam-deflection magnet and energy control system of the Utrecht cascade generator are described. The uniform-field magnet has entrance and exit slits located outside the magnetic field. Since the cascade generator produces a vertical beam, the most convenient choice for the angle of deflection was 90°. The radius of curvature of the beam in the region of the uniform field is 20 cm, which makes it possible to deflect a one-Mev beam of He^+ or D_2^+ ions with a field of 14.5 kilogauss. The whole assembly of the magnet and slits can be rotated about the incoming beam in order to direct the beam to different experimental arrangements. Energy control is achieved in two steps; first, the exciting current of the magnet is stabilized, the magnetic field being measured with a proton magnetic resonance fluxmeter, and, second, the high tension is controlled so as to maintain the deflected beam centered on the exit slit of the magnet. The expected energy resolution of the system was verified down to an energy spread (full width at half maximum) of 0.15% in proton energy. At this resolution a useful beam ($\approx 2\ \mu A$) is obtainable with a high-frequency ion source delivering a total beam of about 40 μA protons. The $Al^{27}(p,\gamma)$ reaction yield curve was resolved at the 504 to 506 kev. (auth)

24931

THE UTRECHT 850 kv CASCADE GENERATOR. II. THE BEAM INTEGRATOR AND GALVANOMETER. P. J. M. Smulders and P. B. Smith (Rijksuniversiteit, Utrecht). Nuclear Instr. & Methods 8, 40-5(1960) July. (In English)

A current integrator is described for the integration of currents from 0.01 to 500 μA with an accuracy of 0.1%. The principle used is essentially the same as that of the excellent circuit described earlier by Helmer and Hemmendinger. The modifications effected result in a considerable reduction in expense as well as a lower input impedance. Owing to increased high-frequency gain, much smaller condensers are necessary in order to maintain the input voltage within some hundredths of a volt of ground at all times. The integrated current is measured as the number of output pulses, each pulse representing a fixed amount of charge. Except for the condensers, no special components are used. A low-impedance electronic galvanometer for operation in series with this integrator is also described. This circuit combines the advantages of imperceptible zero drift, fixed calibration, and essentially absolute protection against burn-out. (auth)

24932

A STABILIZING SYSTEM FOR A 700 kv CASCADE GENERATOR. J. C. Tiemeyer (N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). Nuclear Instr. & Methods 8, 117-20(1960) July. (In English)

A 700 kv four-stage cascade generator in open air driving an ion-accelerating tube with a beam current of 1.2 ma was stabilized by a double-loop feedback system. A stability of the high voltage of 0.03% per hour with a maximum deviation of 0.1% was noted on the measuring potentiometer. The energy resolution was found to be ~100 ev by measuring (p,γ) resonances in Al^{27}. (auth)

24933

IMPROVEMENTS IN PARTICLE ACCELERATORS. (to Commissariat a l'Energie Atomique). British Patent 844,530. Aug. 10, 1960.

A drift-tube proton synchrotron is designed for Bev energies; this synchrotron avoids the disadvantages of conventional drift-tube accelerators (e.g., lowering of tube potential by the conductor connecting to the h-f generator and phase difference between the generator and tube voltages). In the design the whole of the device between the conductor and chamber acts as a high resistance under resonance conditions, thereby insuring that the conductor self-inductance has little or no effect on the h-f voltage and phase difference. (D.L.C.)

24934

IMPROVEMENTS IN OR RELATING TO MAGNETS FOR CYCLIC PARTICLE ACCELERATORS. (to Commissariat à l'Énergie Atomique). British Patent 845,668. Aug. 24, 1960.

The two-pole piece magnet in synchrotrons is designed so that the gradient dB/dR and the index $((R_0/B_0)(dB/dR))$ is held constant without the drawbacks of correction windings; this is done by correction zones in the pole pieces having lower magnetic permeability. In this way, correction can be obtained without reducing the air induction which should be kept as high as possible for maximum particle energy. (D.L.C.)

Plasma Physics and Thermonuclear Processes

24935 APGC-TN-60-75
Florida State Univ., Tallahassee.
PLASMA PHYSICS. S. Gartenhaus. July 1, 1960. 97p.
Contract AF08(635)-723.

Lecture Notes for 1960 Summer Seminar Sponsored by the Florida State University Graduate Center.

The purpose of the seminar was to give the participants a fairly comprehensive introduction to the subject of plasma physics, with emphasis on the underlying physical principles. The topics covered include Maxwell's equations, orbit theory, the collapse of an axial pinch, the equations of magnetohydrodynamics, and the Vlasov-Boltzmann equation. (auth)

24936 JPLAI-LS-183
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
PLASMA PHYSICS AND MAGNETO-FLUID-DYNAMICS. Astronautics Information Literature Search No. 183. Rowena Rodabaugh. Jan. 1960. 179p. Contract NASw-6.

An annotated bibliography containing 903 abstracts and title lists is presented on plasma physics and magneto-fluid-dynamics. The majority of the references fall within the period 1957 to 1959. (W.D.M.)

24937 MAB-167-M
National Research Council. Materials Advisory Board.
DEVELOPMENT AND POSSIBLE APPLICATIONS OF PLASMA AND RELATED HIGH-TEMPERATURE GENERATING DEVICES. Aug. 30, 1960. 229p. Contract DA-36-039-sc-76436.

A description and the general nature of plasma are given. Methods for obtaining ultrahigh temperatures, applications of plasma and related devices, status of research completed or in progress, and the physics and chemistry of plasma flames are discussed. Questionnaires were sent to more than 250 individuals and establishments to determine the level and direction of current activities in materials research and development. The replies from these questionnaires are summarized. Brief summaries of selected reference are included. (W.D.M.)

24938 NP-8969
Defense Atomic Support Agency. Field Command, Albuquerque, N. Mex.
SUMMARY OF SHERWOOD ACTIVITIES. Wendell S. Winn. Aug. 15, 1960. 61p.

In the period since the Geneva conference of 1958, investigations using the large devices have been deemphasized in favor of more basic experiments. The pinch devices have been explored from many directions. At many laboratories effort has been turned to other projects, such as new plasma-injection techniques and a new containment scheme, the cusp geometry. A new and powerful heating mechanism resulting from the trapping or mixing of fields, which are then destroyed, is being studied at several laboratories. A serious question of energy loss, electron cyclotron radiation, applicable to all types of magnetic confinement where the plasma and magnetic field lines are in contact, has been discussed in exchanges between USSR and U.S. scientists. Three large experimental devices which were conceived several years ago are in the later stages of construction. These are the Astron at Lawrence Radiation Laboratory, the Model C Stellarator at Princeton University, and the Direct Current Experiment No. 2 (DCX-2) at Oak Ridge National Laboratory. (auth)

24939 NP-9067
Michigan. Univ., Ann Arbor.
THE KINETIC THEORY OF FULLY IONIZED GASES. Ralph L. Guernsey. July 1960. 138p. UMRI Project No. 03114. Contract Nonr 1224(15).

The possibility of deriving a kinetic equation that will replace the Boltzmann equation for a fully ionized gas is investigated. The approach is a modification of that employed by Bogolubov in obtaining the Boltzmann equation and its generalizations for an ordinary gas from the Liouville equation. (W.D.M.)

24940 TID-6265
P. E. C. Corp., Boulder, Colo.
AN INVESTIGATION OF THE EQUILIBRIUM PROPERTIES OF A FULLY IONIZED GAS. Quarterly Report No. 7 Covering the Period from March 1, 1960—May 31, 1960. W. E. Brittin. 32p. Contract AT(11-1)-669. OTS.

Further results on numerical calculations for a binary plasma equation of state are presented. Graphs presenting values of θ'_0 are shown. θ'_0 is given for values of Z from 1 to 5. Following the graphs are the numerical results used to construct the graphs. (W.D.M.)

24941 AEC-tr-4073
Akademiya Nauk S.S.S.R. Institut Atomnoĭ Energii. Moskovskiĭ Inzhenerno-Fizicheskii Institut.
MAGNETIC EMISSION OF HIGH TEMPERATURE PLASMA. B. A. Trubnikov. Translated from a thesis "Magnitnoe Izluchenie Vysokotemperaturnoĭ Plasmy." 1958. 162p. OTS.

Problems relating to the emission of electrons from a high-temperature plasma, moving in a magnetic field, are examined. Attention is devoted to the emission and absorption of waves with frequencies exceeding several times the gyromagnetic frequency of the electrons. Results are utilized for assessing the role of magnetic emission in the energy balance of a D or D-T plasma. It is shown that the magnetic emission losses impose strict restrictions on the size of the plasma systems within which a thermonuclear reaction based on pure D could be self-sustaining. (W.D.M.)

24942
PLASMA OSCILLATIONS IN A STATIC EXTERNAL MAGNETIC FIELD. S. Ciulli and M. Micu. Acad. rep. populare Romîne, Inst. fiz. atomică, şi Inst. fiz'., Studii cercetări fiz'., 9, 489-96(1958). (Translated from Referat. Zhur. Fiz. No. 1, 1960, abstract No. 1528).

By using the Boltzmann equation, the distribution function is found for a beam of electrons in a plasma with cylindrical symmetry, located in an axial magnetic field. The perturbations of the stationary distributions are investigated by calculating the deviations of the first-order moments from their Maxwellian value. The values of the perturbations of the magnetic field and of the distribution functions are expanded in Fourier series, and a homogeneous system of differential equations is obtained for their amplitude. An analysis is given of the asymptotic solutions of the system, and from the condition of regularity of the solutions a scattering relation is derived for the oscillations of various frequencies. The stability of the plasma is ensured for values of experimental parameters that enter into the scattering relation Im $\omega \leq 0$ for any ω, k, and n.

24943
FUSION REACTIONS RESULTING FROM DISCHARGES IN DEUTERIUM. Hans Witt (High-voltage Lab., Ludvika, Sweden). ASEA Journal 33, 114-22(1960). (In English)

Following a summary of the nature of the fusion process, a description is given of the part played by Asea in the experiments that are being carried out at the Institute of Physics at Uppsala University. Among the subjects considered are experiments with straight discharge tubes, and the new experimental reactor with tubes of toroidal design. Some possible solutions of the problem of the long-term confinement of plasma are suggested. (auth)

24944
THE RESOLUTION OF THE FOKKER-PLANCK EQUA-

TION OF A PLASMA. Mircea Drăganu. Compt. rend. 251, 518-20(1960) July 25. (In French)

A method for the resolution of the Fokker-Planck equation of a plasma in polar coordinates without azimuthal symmetry is given by developing the solution in series of spherical harmonics. (tr-auth)

24945

SOME AUTOMODEL GAS MOTIONS WITH PLANE WAVES IN MAGNETIC FLUID DYNAMICS. O. A. Berezin (Inst. of Electromechanics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 133, 296-8(1960) July 11. (In Russian)

The solution developed for the nonstationary motion of an ideal gas in a transverse magnetic field, $h_z = H_z^2/8\pi$ (infinite conductivity and low viscosity and heat transfer), is used in studies of the amplification of magnetic field in a hydromagnetic dynamo. The device consists of a tube constructed of isolator material, magnetoconductor, excitation coils, contact plates, and the amperemeter. The installation may be considered a generator of constant self-exciting current. The physical picture of a conducting medium was plotted and analyzed. (R.V.J.)

24946

COLLISION OF TWO PLASMA STREAMS. W. E. Nexsen, Jr., W. F. Cummins, F. H. Coensgen, and A. E. Sherman (Univ. of California, Livermore). Phys. Rev. 119, 1457-9 (1960) Sept. 1.

It has been predicted that under certain conditions the counter-streaming of colliding plasma streams should be unstable and should be stopped in a very short distance with the translational energy being converted to the energy of ion or electron oscillations. The collision of two plasma streams satisfying one set of conditions for which instability had been predicted was studied experimentally, and no evidence of instability was observed. Study of the plasma dispersion equation indicates that much more rigorous conditions must be met before such instability should occur. (auth)

24947

EQUILIBRIUM PROPERTIES OF A PARTIALLY IONIZED PLASMA. Gilda Maki Harris, John E. Roberts, and John G. Trulio (Univ. of California, Livermore). Phys. Rev. 119, 1832-41(1960) Sept. 15.

A model for a partially ionized, partially dissociated plasma was formulated using known theoretical concepts to describe both bound and free electron states, internal molecular degrees of freedom, and Coulomb interactions. It was applied to a system of particles arising from the hydrogen molecule. The Coulomb interaction was treated in the classical Debye approximation. However, a distance of closest approach between ions and electrons depending on the kinetic energy of the electrons was included to avoid the short-range divergence of the Coulomb potential. The kinetic energy of the free electrons was calculated from the partition function for a perfect Fermi gas. The vibrational and rotational motion were treated in the harmonic oscillator and rigid rotor approximation with the number of energy levels counted for a given electronic state depending on the dissociation energy of the state. A volume dependence of the bound electronic energy eigenvalues was included by considering the effect of surrounding particles as a confinement of a given particle to a spherical box of variable size. For the counting of the bound electronic states, a given state was bound until its energy increased to zero due to confinement. From the partition function for the entire system, the free energy was calculated. By a minimization of the free energy of the system, the equilibrium composition as a function of temperature and volume was obtained. Then not only could thermodynamic quantities be calculated, but a reasonable approximation to the correct balance of molecular, ionic and free electronic states was achieved over a wide range of v-T space. Consequently, regions where incomplete ionization and dissociation were important were delineated. In addition, for different regions of v-T space, the relative contributions of charged particle interaction of the nonclassical behavior of electrons, of internal degrees of freedom and of translation to the total energy of the system could be determined. (auth)

24948

DIELECTRIC CONSTANT OF A DENSE ELECTRON GAS. T. Pradhan and P. Misra (Utkal Univ., Cuttack, India). Phys. Rev. 119, 1878-81(1960) Sept. 15.

The problem of absorption and dispersion of electromagnetic waves in a dense electron gas is treated semiclassically by the use of Boltzmann equation and Fermi-Dirac statistics. The singularity in the dispersion formula is treated by the method of Van Kampen. Expressions for the dielectric constant and conductivity as functions of frequency were obtained for temperatures at and near absolute zero. (auth)

24949

MOTION PHENOMENA IN THE LINEAR PINCH EFFECT AND RUNAWAY ELECTRONS. E. Fünfer, G. Lehner, and H. Tuczek (Technische Hochschule, Munich). Z. Naturforsch. 15a, 566-74(1960) July. (In German)

The time dependence of plasma radius and current is calculated on the assumption of homogeneous plasma in the case of the linear stabilized pinch effect. The comparison with the experiment shows a good conformity in regard to the contraction times. It is found by theory and by experiments that the contraction times are independent of the stabilizing magnetic field. Measurements of the longitudinal magnetic flux give the temporal and spatial dependence of the induced azimuthal electric field in good agreement with the theory. A deviation at the beginning of the compression is attributed to the paramagnetic effect. A comparison with the theory of Dreicer shows that the measured field strengths are sufficient for the production of runaway-electrons. This gives an explanation for the hard x rays which are found in the experiments. (auth)

24950

THE POSSIBILITY OF THE DIRECTED INTRODUCTION OF DEUTERIUM AND TRITIUM IN NUCLEAR FUSION EXPERIMENTS. E. W. Becker, R. Klingelhöfer, and P. Lohse (Technische Hochschule, Karlsruhe, Ger.). Z. Naturforsch. 15a, 644-5(1960) July. (In German)

A beam-production system for a "condensed" molecular beam is described. The molecular current density obtained with the system is determined as a function of the input pressure for various distances between receiver and collimator screen. The maximum beam is obtained for a distance of 45 mm. It was shown that the "condensed" beam has a perpendicular profile. (J.S.R.)

24951

THE EFFECT OF THE DISSOCIATION OF MOLECULES INTO IONS ON THE PRESSURE DEPENDENCE OF THE ELECTRON TEMPERATURE IN THE PLASMA OF THE POSITIVE COLUMN OF A GLOW DISCHARGE. B. A. Engelke (Technische Hochschule, Brunswick). Z. Physik 159, 373-7(1960). (In German)

If a dissociation of gas molecules into ions occurs in the plasma of the positive column of a glow discharge, then in the theoretical treatment of such a plasma, the negative ions arising in this process especially are to be considered.

Under simplifying assumptions in the case of a cylindrical symmetrical discharge space, the radial electron density distribution can be described by two Bessel differential equations of the zero order. With the usual boundary conditions a relation from which the pressure dependence of the electron temperature can be found can be obtained from both these equations. It is shown that the dissociation of gas molecules into ions in the column plasma leads to a lowering of the electron temperature. (tr-auth)

24952
FINITE AMPLITUDE WAVES IN A MULTI-COMPONENT CONDUCTING MEDIUM. V. S. Tkalich. Zhur. Eksptl'. i Teoret. Fiz. 39, 73-7(1960) July. (In Russian)

The equation set for a nonideal plasma in the hydrodynamic approximation is reduced to a linear set without the assumption of smallness of the signal. Propagation of finite amplitude waves in the presence of a magnetic field is studied. A comparison is made with familiar results obtained under other assumptions. (auth)

24953
ON THE INSTABILITY OF A PLASMA WITH AN ANISOTROPIC DISTRIBUTION OF VELOCITIES IN A MAGNETIC FIELD. R. Z. Sagdeev and V. D. Shafranov. Zhur. Eksptl'. i Teoret. Fiz. 39, 181-4(1960) July. (In Russian)

It is shown that even at a weak temperature anisotropy, $|T_\perp - T_\parallel|/T_\perp \ll 1$, a plasma in a uniform magnetic field is unstable. The instability is due to those charges in the "tail" of the velocity distribution which are in cyclotron resonance with the perturbation wave. (auth)

24954
PLASMA PHYSICS AND THE PROBLEM OF CONTROLLED THERMONUCLEAR REACTIONS. VOLUME IV. M. A. Leontovich, ed. and J. Turkevich, trans. ed. Translated by Serge Shewchuck. New York, Pergamon Press, 1960. 515p.

Included is a collection of papers translated from Russian concerning work completed through 1958 on plasma physics and thermonuclear reaction control problems. There are 35 papers for which reference is made for each to the original language publication. The equations were reproduced exactly as in the original volume. (B.O.G.)

24955
CONTAINMENT OF A PLASMA BY A TRAVELLING MAGNETIC FIELD. S. M. Osovets. p.1-16 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 666.

24956
HYDRODYNAMICS OF A LOW PRESSURE PLASMA. B. B. Kadomtsev. p.17-25 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 667.

24957
MAGNETOHYDRODYNAMIC WAVES IN A RAREFIED PLASMA. S. I. Braginskii and A. P. Kazantsev. p.26-34 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 668.

24958
MOTION OF CHARGED PARTICLES IN A MAGNETIC TRAP. L. S. Solov'ev (Solov'yev). p.35-45 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 669.

24959
THE MOTION OF CHARGED PARTICLES IN RAPIDLY OSCILLATING ELECTROMAGNETIC FIELDS. A. A. Vedenov and L. I. Rudakov. p.46-53 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 670.

24960
STABILIZATION OF A PLASMA BY MEANS OF A SYSTEM OF RODS. D. V. Orlinskii. p.54-62 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 671.

24961
STUDY OF THE STABILITY OF A CYLINDRICAL PLASMA COLUMN BY A METHOD EMPLOYING THE BOLTZMANN EQUATION. L. I. Rudakov and R. Z. Sagdeev. p.63-70 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 672.

24962
THE STABILITY OF A PLASMA COLUMN WITH A DISTRIBUTED CURRENT. V. D. Shafranov. p.71-80 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 673.

24963
CALCULATION OF A QUASI-STATIONARY ELECTROMAGNETIC FIELD IN A SYSTEM WITH TOROIDAL GEOMETRY. N. M. Polievktov-Nikoladze. p.81-93 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 674.

24964
STUDY OF NEUTRON EMISSION FROM A 160 kA GAS DISCHARGE. V. F. Demichev and Yu. G. Prokhorov. p.94-100 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 675.

24965
A POSSIBLE MECHANISM FOR THE NEUTRON PRODUCTION IN POWERFUL PULSED DISCHARGES IN DEUTERIUM. B. A. Trubnikov. p.101-13 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 676.

24966
EFFECT OF A HIGH-FREQUENCY ELECTROMAGNETIC FIELD ON PLASMA OSCILLATIONS. T. F. Volkov. p.114-26 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 677.

24967
OSCILLATIONS AND STABILITY OF THE SURFACE OF A

PLASMA IN THE FIELD OF A TRAVELLING ELECTROMAGNETIC WAVE. T. F. Volkov. p.127-34 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 678.

24968

A HIGH-CURRENT ELECTRODELESS DISCHARGE IN A TOROIDAL CHAMBER WITH A LONGITUDINAL MAGNETIC FIELD. I. EXPERIMENTAL SET-UP. A. L. Bezbatchenko, I. N. Golovin, P. I. Kozlov, V. S. Strelkov, and N. A. Yavlinskii. p.135-56 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 679.

24969

MEASUREMENTS OF ELECTRON TEMPERATURE AND ION CONCENTRATION BY A DOUBLE FLOATING PROBE IN AN ELECTRODELESS DISCHARGE. V. I. Pistunovich. p.157-80 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 680.

24970

STUDY OF RADIATION FROM AN ELECTRODELESS DISCHARGE IN DEUTERIUM. V. S. Strelkov. p.181-97 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 681.

24971

POWERFUL PULSED GAS DISCHARGES IN CHAMBERS WITH CONDUCTING WALLS. D. P. Petrov, N. V. Filippov, T. I. Filippova, and V. A. Khrabrov. p.198-212 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 382.

24972

STUDY OF A PULSED DISCHARGE IN DEUTERIUM FOR CURRENT RATES OF RISE UP TO 10^{12} A/sec AND VOLTAGES UP TO 120 kV. A. M. Andrianov, O. A. Bazilevskaya, and Yu. G. Prokhorova. p.213-35 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 683.

24973

THEORY OF THE COMPRESSION AND OSCILLATION OF A PLASMA COLUMN IN A POWERFUL PULSED DISCHARGE. S. I. Braginskii, I. M. Gel'fand, and R. P. Fedorenko. p.236-61 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 684.

24974

STUDY OF THE PROCESS OF ELECTRODYNAMIC ACCELERATION OF PLASMA BUNCHES. [PART] II. I. M. Podgornyi (Podgorny), S. A. Chuvatin, G. A. Bykov, and V. D. Pis'mennyi. p.262-76 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 685.

24975

RADIAL DISTRIBUTION OF POTENTIAL IN A CYLINDRICAL MAGNETIC TRAP WITH A MAGNETRON METHOD OF ION INJECTION. E. E. Yushmanov. p.277-304 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 686.

24976

BROADENING OF SPECTRAL LINES IN A HIGH TEMPERATURE PLASMA. V. I. Kogan. p.305-62 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 687.

24977

RELATION BETWEEN COEFFICIENTS OF ABSORPTION AND EMISSION OF RADIATION FOR A PLASMA IN A MAGNETIC FIELD. B. A. Trubnikov. p.363-6 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 688.

24978

THE BEHAVIOUR OF PLASMA IN A RAPIDLY-VARYING MAGNETIC FIELD. B. A. Trubnikov. p.367-91 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 689.

24979

ČERENKOV GENERATION OF MAGNETO-ACOUSTIC WAVES. A. I. Morozov. p.392-416 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 690.

24980

MAGNETIC TRAPS FOR PLASMA. B. B. Kadomtsev. p.417-30 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 691.

24981

PLASMA INSTABILITY IN A MAGNETIC FIELD IN THE PRESENCE OF ION BEAMS. B. B. Kadomtsev. p.431-7 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 692.

24982

PLASMA DYNAMICS IN A STRONG MAGNETIC FIELD. B. B. Kadomtsev. p.438-49 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 693.

24983

CONVECTIVE INSTABILITY OF A PLASMA. B. B. Kadomtsev. p.450-3 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 694.

24984

NON-LINEAR MOTIONS OF A RAREFIED PLASMA IN A

MAGNETIC FIELD. R. Z. Sagdeev. p.454-60 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 695.

24985

DAMPING OF THE OSCILLATIONS OF A PLASMA COLUMN. A. I. Morozov and L. S. Solov'ev (Solov'yev). p.461-88 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 696.

24986

DERIVATION OF THE DIELECTRIC PERMEABILITY TENSOR OF A PLASMA. V. D. Shafranov. p.489-94 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 697.

24987

ABSORPTION OF ELECTROMAGNETIC WAVES PROPAGATED ALONG A CONSTANT MAGNETIC FIELD IN A PLASMA. R. Z. Sagdeev. p.495-8 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 698.

24988

THE INDEX OF REFRACTION OF A PLASMA IN A MAGNETIC FIELD IN THE REGION OF ION CYCLOTRON RESONANCE. V. D. Shafranov. p.499-503 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 699.

24989

OSCILLATIONS OF A PLASMA COLUMN TAKING INTO ACCOUNT THERMAL MOTION OF THE IONS. R. Z. Sagdeev and V. D. Shafranov. p.504-10 of "Plasma Physics and the Problem of Controlled Thermonuclear Reactions. Volume IV."

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 700.

24990

IMPROVEMENTS IN OR RELATING TO DISCHARGE DEVICES FOR PRODUCING NUCLEAR REACTIONS BY BOMBARDING A TARGET MATERIAL WITH HYDROGEN IONS. Leslie Edward Collins (to United Kingdom Atomic Energy Authority). British Patent 838,461. June 22, 1960.

A discharge device was invented that produces neutrons by D-D or D-T fusion reactions and comprises a glass envelope containing the following electrodes: anode, trigger electrode, target electrode, and aperture electrode positioned between the anode and trigger electrode on one side and the target electrode on the other side. A block of lithium cold-pressed deuteride and copper powder, or some other suitable material containing deuterium or tritium, is mounted on the anode; and the target electrode has a tritiated surface. In operation, the aperture electrode is grounded; and the anode and target electrode are connected to potentials of +5 and −40 kv, respectively. To produce neutron bursts, a -100 kv pulse is applied to the trigger electrode producing an arc between it and the anode and another (main) arc between the anode and the aperture electrode. The arcs release deuterons to bombard the target electrode. Using an aperture electrode made from 0.010-in. nickel sheet with a 3- to 4-mm-diameter hole, a 1-mm-diameter tungsten wire as trigger electrode, and a 1-in.-diameter target placed 10 cm from the aperture electrode, neutron bursts of 1 to 5 μsec duration and 10^4 to 10^5 neutrons/μsec intensity were obtained. (D.L.C.)

24991

IMPROVEMENTS IN OR RELATING TO GAS DISCHARGE APPARATUS. Philip Alan Davenport (to United Kingdom Atomic Energy Authority). British Patent 843,614. Aug. 4, 1960.

A gas discharge apparatus is designed which comprises a torus having one or more insulating gaps and a liner of overlapping insulated metal segments with means for sealing off the annular space between the liner and the torus, thereby reducing the tendency of the gaps to break down. The sealing means is gastight, and the annular space is maintained at a different pressure than that within the liner. (D.L.C.)

24992

IMPROVEMENTS IN OR RELATING TO GAS DISCHARGE APPARATUS. Peter Clive Thonemann (to United Kingdom Atomic Energy Authority). British Patent 843,615. Aug. 4, 1960.

A toroidal gas discharge apparatus with a liner between the discharge and the torus wall is designed in which the liner is made from continuous corrugated stainless steel rather than overlapping insulated metal segments. The resistance of the corrugated liner is large compared with that of the discharge. (D.L.C.)

24993

IMPROVEMENTS RELATING TO THERMO NUCLEAR REACTORS FOR PRODUCING FUSION REACTIONS. Jiri George Linhart (to British Thomson-Houston Co., Ltd.). British Patent 846,547. Aug. 31, 1960.

A thermonuclear reactor is designed in such a way that the necessary ion temperatures for fusion reactions are produced by adiabatic compression. The compression is effected by propagating magnetic shock waves in an ionized light gas (H_2, D_2, He, T_2, or a mixture), and temperatures above 10^8°K should be possible. Complete details of the formulas and apparatus are given. (D.L.C.)

Shielding

24994 AE-24

Aktiebolaget Atomenergi, Stockholm.

TRANSMISSION OF THERMAL NEUTRONS THROUGH BORAL. F. Åkerhielm. Aug. 1959. 17p.

Transmission measurements were performed using Maxwellian distributed neutrons from the R-1 reactor perpendicularly incident upon a boral absorption plate. American, English, German, Swedish, and Swiss samples were investigated and the results are compared to calculated values. The influence of the absorber grain size is discussed. (auth)

24995 HW-61755(Pt.2)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

Z PLANT RADIATION STUDY INTERIM REPORT NO. 5. PART II. DATA ON GAMMA SHIELDING OF SPECIAL PLUTONIUM SAMPLES. H. A. Moulthrop. Oct. 22, 1959. 103p. Contract W-31-109-eng-52. OTS.

The effectiveness of lead, lead glass, steel, safety glass, and plexiglas for shielding gamma radiation from plutonium samples, including powders, solution, and metal, was evaluated. (C.J.G.)

24996
STATE OF DEVELOPMENT IN THE RANGE OF REACTOR SHIELDING. II. THEORY AND PRACTICE. Ir. H. van Ammers. Atoomenergie 2, 123-9(1960) Aug. (In Dutch)

In this second part of the article on reactor shielding, neutron shielding is first discussed. Then safety shielding is considered. A brief survey on radiation detection instruments used for examination of shielding is given. 16 references. (tr-auth)

24997
TWO GROUP CALCULATION OF CAPTURE GAMMA-RAYS FROM INFINITE SLAB. Noboru Hokkyo and Mitsuyuki Kitazume (Hitachi Ltd., [Tokyo]). J. Atomic Energy Soc. Japan 2, 474-7(1960) Aug. (In Japanese)

The expression for the intensity of γ radiation that is generated in an infinite slab shield owing to thermal-neutron capture and escapes across the front and rear faces of the material is obtained for given fast- and thermal-neutron currents incident on the shield. The result is based on the two-group approximation for the thermal-neutron distribution and is a natural extension of Ilffe's result, which does not take the incident fast neutron into account. (auth)

Theoretical Physics

24998
INDEFINITE METRIC IN THE SPACE OF STATES AND PROBABILITY INTERPRETATION. [PART] III. Siegfried Schlieder (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 15a, 555-65(1960) July. (In German)

The content of Part I was the construction of the fundamental metric tensor; in Part II the conditions which make possible the probability interpretation for elements lying in the same coherent sector were discussed. The subject of this part (III) is the space of states as a whole. The existence of superselection rules allows the fundamental tensors formerly introduced as identity matrix in the subspace of the physical states to be given up. The mathematical form in which symmetry groups appear is shown by an example. Finally, a possible generalization for the dual element of an element is given. (auth)

24999
THE MULTIPLICITY OF INFORMATION-INDEPENDENT STATES IN THE QUANTUM THEORY. Friedrich Schlögl (Universität, Cologne). Z. Physik 159, 411-27(1960). (In German)

An investigation was made to determine how far the assumptions that lead in quantum theory to the representability of observables by linear operators result from the existence of nonsimultaneous measurable magnitudes. A basic assumption appears to be arbitrary insofar as it represents only one single postulate. According to this, quantum mechanical systems whose space states consist of more than two dimensions permit only two maximum measurements independent of each other. This fact leads to the distinction of complementary measurement magnitudes that are defined also in the single considered single-dimensional space states. All observables of a system are represented as functions of these complementary magnitudes. (tr-auth)

25000
QUANTUM ELECTRODYNAMICS AND ASYMPTOTIC CONDITIONS. H. Rollnik, B. Stech, and E. Nunnemann (Universität, Heidelberg, Ger.). Z. Physik 159, 482-94(1960). (In German)

The asymptotic conditions for the field operators are used in order to employ only renormalized quantities in quantum electrodynamics and to avoid the usual procedure of adiabatic switching off of the interaction. The treatment is based mainly on invariance properties and therefore gives a somewhat simpler formulation of the renormalization procedure. (auth)

REACTOR TECHNOLOGY

General and Miscellaneous

25001 AECL-1064
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE ECONOMIC AND TECHNICAL POSITION OF HEAVY-WATER REACTORS IN CANADA. J. L. Gray. July 1960. 11p.

An address to the Third Inter-American Symposium on the Peaceful Application of Nuclear Energy, Rio de Janeiro, July 21, 1960.

A résumé of the development and status of Canadian heavy-water reactors is presented. Reasons for confidence in designs for these reactors are listed and discussed. (J.R.D.)

25002 AECL-1067
Atomic Energy of Canada Ltd., Chalk River, Ont.
ANNUAL REPORT, 1959–1960. 37p.

In June 1959 the construction of the first full-scale nuclear power station in Canada was authorized, and subsequently a site was selected for this 200-Mw(e) plant at Douglas Point. The establishment of a new research and development center in Manitoba was announced in October. It is known as the Whiteshell Nuclear Research Establishment and will be located on the Winnipeg River about 60 miles northeast of Winnipeg. The construction of the 20-Mw(e) Nuclear Power Demonstration station continued on schedule. The fifth research reactor at Chalk River, ZED-2, was essentially completed. The Canada-India Reactor near Bombay was nearly ready for initial start-up at the end of the year. A technical agreement for cooperation was signed with Euratom which includes a joint program of research and development on heavy-water-moderated power reactors. A reactor school was opened at Chalk River. Financial statements of the company are appended. (W.D.M.)

25003 AEEW-R-34
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith, Dorset, England.
ERRORS DUE TO THE CYLINDRICAL CELL APPROXIMATION IN LATTICE CALCULATIONS. D. A. Newmarch. June 1960. 19p. BIS.

It is shown that serious errors in fine structure calculations may arise through the use of the cylindrical cell approximation together with transport theory methods. The effect of this approximation is to overestimate the ratio of the flux in the moderator-to-flux in the fuel. It is demonstrated that the use of the cylindrical cell approximation gives a flux in the moderator which is considerably higher than in the fuel, even when the cell dimensions in units of mean free path tend to zero; whereas, for the case of real cells (e.g., square or hexagonal), the flux ratio must tend to unity. It is also shown that, for cylindrical cells of any size, the ratio of the flux in the moderator-to-flux in the fuel tends to infinity as the total neutron cross section in the moderator tends to zero; whereas the ratio remains finite for real cells. (auth)

25004 AERE-M-597
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
USE OF HASSITT PROGRAM FOR MULTIGROUP CALCULATIONS FOR FAST REACTORS. T. P. Moorhead. Dec. 1959. 9p.

25005 AERE-M-712
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
NEUTRON TEMPERATURE IN REACTORS HAVING MODERATOR CLOSELY ASSOCIATED WITH FUEL ELEMENTS. R. G. Freemantle and J. S. Harper. June 22, 1960. 14p. BIS.

Declassified version of AERE-R/M-227, Jan. 1959.

Experiments are described to measure the neutron temperature in graphite moderator with air channels containing heated graphite sleeves. (auth)

25006 ANL-6034
Argonne National Lab., Ill. and Argonne National Lab., Idaho Falls, Idaho.
DESIGN SUMMARY REPORT ON THE TRANSIENT REACTOR TEST FACILITY (TREAT). G. A. Freund, D. R. MacFarlane, P. Elias, J. D. Geier, and J. F. Boland. Feb. 1960. 124p. Contract W-31-109-eng-38. OTS.

The Transient Reactor Test Facility (TREAT) is an air-cooled, thermal, heterogeneous system designed to evaluate reactor fuels and structural materials under conditions simulating various types of nuclear excursions. The immediate objective of TREAT is to provide quantitative data and visual information on the mechanism of melting of fast reactor fuel elements by nuclear heating analogous to a power excursion in a fast-reactor core. The core assembly, core support and alignment, permanent reflector and thermal column, control rods, control-rod drives, shielding, fuel-transfer system, reactor-cooling and building-ventilation system, and control and instrumentation are discussed. (W.D.M.)

25007 BAW-1182
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
GAS-SUSPENSION REACTOR COOLANTS. D. C. Schluderberg. Dec. 1959. 27p. OTS.

The gas-suspension coolant experimental work demonstrates that the addition of a suspension of finely divided graphite in low pressure CO_2, N, or He produces a coolant which has excellent high-temperature heat-transfer and heat-transport capabilities without sacrificing the advantages of gas coolants. Gas-suspension coolants appear to be capable of effecting substantial reductions in capital, fuel, and operating costs of nuclear power plants by eliminating such undesirable reactor coolant characteristics as high pressure, poor materials compatibility, special hazards and handling problems, scarcity, high neutron cross section, susceptibility to radiation damage, and incompatibility with high-temperature operation. Consequently, progress should be greatly accelerated toward truly competitive nuclear power generation costs. (auth)

25008 CF-60-2-2
Oak Ridge National Lab., Tenn.
XENON CONTROL IN FLUID FUELED REACTORS. W. D. Burch, G. M. Watson, and H. O. Weeren. July 6, 1960. 33p. OTS.

A comparison of methods proposed for xenon control in the three major fluid-fuel reactor types (Aqueous Homogeneous, Molten Salt, and Liquid Metal Fuel Reactors) indicates no significant differences in the minimum practical poison level or the cost to achieve the level. All three systems have the capability of operating at xenon poison fractions of 0.01 or less, and the estimated costs of these processing systems are less than the value of the neutrons saved. (auth)

25009 CF-60-8-39
Oak Ridge National Lab., Tenn.
HFIR RESPONSE TO VOID SWEPT INTO FLUX TRAP. R. S. Stone. Aug. 10, 1960. 9p. OTS.

Flux excursions in the HFIR and the response of its safety system have been examined for the situations arising from voids swept into the flux trap with the cooling water. It was found that by limiting the addition of void reactivity to $1.00 or less, temperature coefficients alone can handle the excursion without damage to the core. Curves are given which show the safety system response necessary for larger additions of void reactivity. (auth)

25010 HW-58706
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DYNAMIC CONTROL CHARACTERISTICS OF THE PLUTONIUM RECYCLE TEST REACTOR. Harold K. Nelson. Jan. 2, 1959. 71p. Contract AT(45-1)-1350. OTS.

A study of the PRTR neutron kinetics and the moderator gas-balance system response to transients was made using analog-simulation techniques. Analytical equations were developed to describe the variables which affect the control of the PRTR. These equations were then combined to form mathematical models of the entire system and system components or subsystems. An analog study was conducted on the basis of these mathematical models, utilizing frequency-response techniques to investigate and describe both the subsystems and the entire reactor system. The results which were obtained are presented on standard frequency-response diagrams. The moderator gas-balance system was found to have a natural or resonance frequency in the vicinity of 0.4 cycles. Application of stability criteria to the gas-balance system showed a tendency toward instability. However, disturbing influences of significant magnitude to cause operating difficulty are not believed to be present. Some oscillation of moderator level and power is postulated but this effect may be too small to be measured without special equipment. (auth)

25011 HW-60388
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
709 PROGRAM FOR REDUCTION OF EXPONENTIAL PILE DATA. D. D. Matsumoto. May 20, 1959. 14p. Contract [AT(45-1)-1350]. OTS.

An IBM-709 multipurpose program for the reduction of exponential pile data was written. Material buckling is computed from raw data (given counts, time, and counter information or from previously calculated $A_{thermal}$. C_eC_h (end and harmonic corrections) can be computed for a given B_{11} or series of B_{11}'s only. (C.J.G.)

25012 IDO-16616
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
SPERT PROJECT QUARTERLY TECHNICAL REPORT FOR OCTOBER, NOVEMBER, DECEMBER 1959. F. Schroeder, ed. Aug. 24, 1960. 36p. Contract AT(10-1)-205. OTS.

SPERT I. The kinetic-test program using the Oak Ridge National Laboratory BSR-II core at Spert I was planned to yield information pertaining to the safety of the core with and without the ORNL safety system operative and, in addition, to supply detailed performance characteristics for the safety system during short-period power excursions. The data would also add to the store of information on the self-limiting behavior of cores with different physical and nuclear properties. The small stainless-steel plate type BSR-II core was installed in the Spert I reactor and neutron-flux distributions, control-rod worths, and void and temperature coefficients have been measured. The neutron-flux peaking in a water-filled hole in this core was also determined as an aid to the planning of future capsule type experiments. *SPERT III.* The void coefficient of reactivity was measured in the Spert III reactor as a function of system temperature. The average of all measurements was about -2×10^{-4} dollars/cm^3 or −40 cents/% void, which was not in significant disagreement with the density coefficient of 44 cents/% density change (independent of temperature and pressure) obtained from the previous temperature and pressure coefficient data. The reactivity worth of voids in the interior of the Spert III control-rod-poison sections was investigated by the use of a mock-up control rod placed in various core positions. It was estimated that voiding the entire interiors of all eight control-rod-poison sections with the rods fully inserted would result in a reactivity increase of about 2 dollars. A severe blowout of the stuffing box on a motor-operated primary-flow control valve was investigated and the failure was attributed to scoring and galling of the valve stems. Modifications have been made in all such valves to prevent future failures of this type. Failure of a pressure fitting on the reactor top head caused wide-spread wetting of the splash-protected electrical and instrument leads with resultant shorting, arcing, and spurious indications on the control panel. All control wiring and instrument leads in the reactor area were redesigned to provide reliable operation in a steam-saturated atmosphere. *INSTRUMENTATION.* The response of chromel-alumel thermocouples peened to the surface of aluminum-clad fuel plates was investigated as a function of the depth of the junction. It was concluded that the variations in the depth at which a thermocouple is peened into the surface of the 0.020-in.-thick aluminum cladding introduce no significant differences in indicated temperature for reactor periods as short as 14 msec. *THEORETICAL.* In order to investigate the effect of longer thermal-time constants, prompt negative coefficients (as provided by Doppler broadening), and pin type fuel geometry on reactor kinetic behavior, it is planned to perform kinetic tests in the Spert I facility with a low-enrichment core utilizing UO_2 fuel rods of the type used in the N. S. *Savannah*. The core-design parameters for use of these fuel rods in Spert I have been determined. A core loading of 570 fuel pins containing 32.3 kg of U^{235} is estimated to provide an available cold excess reactivity of about 3 dollars. (auth)

25013 LAMS-2433
Los Alamos Scientific Lab., N. Mex.
A PROPOSED FAST REACTOR INSTALLATION PROJECT FRE-EX. Richard J. Watts. Feb. 26, 1960. 14p. Contract W-7405-eng-36. OTS.

A conceptional design for a fast reactor installation is described. This design is based on the argument that the design of highly rated core configurations is so uncertain that some method of minimizing the investment risk of an experimental installation is desirable. The plan is based on the availability of a remote test area such as the Nevada Test Site as a minimum-expense facility. (auth)

25014 MND-1705
Martin Co. Nuclear Div., Baltimore.
REFLECTOR SAVINGS PROGRAM. E. A. Schaefer. Feb. 4, 1959. 12p.

A program was written by FORTRAN for the IBM-704 machine and was designed to calculate the equivalent bare dimension of a specified reflected core. The program is initialized internally and proceeds to iterate until the valve between two successive iterations are within 0.00005 of each other. The program is compatible with the existing Monitor machine system. An error routine is included to assist the Monitor system. (auth)

25015 NDA-2136-1
Nuclear Development Corp. of America, White Plains, N. Y.
PRELIMINARY DESIGN OF THE ORNL FAST BURST REACTOR. G. Breidenbach, D. Burgreen, E. Gahan, B. Minushkin, L. Rutland, H. Soodak, and A. Stathoplos. July 30, 1960. 120p. For Oak Ridge National Lab. Contract 93X-81334-C.

A preliminary design of a Fast Burst Reactor was prepared for ORNL. The mechanical-design features of the reactor and its calculated performance characteristics are described. The reactor resembles the Godiva I and II reactors with the significant exception that U−10 wt.% Mo alloy was used for fuel instead of unalloyed uranium. The reactor is intended to provide bursts of 10^{17} fissions in ~40 μsec and steady-state operation up to 10 kw. (auth)

25016 SCR-229
Sandia Corp., Albuquerque, N. Mex.
THE SANDIA PULSED REACTOR FACILITY (SPRF). J. L. Colp and P. D. O'Brien. Aug. 1960. 16p. OTS.

The Sandia Pulsed Reactor Facility is specifically designed for radiation effects experiments that require an intense pulsed source of fast neutrons and γ radiation. Designed around the Sandia Pulsed Reactor (SPR), the facility includes four buildings and an outdoor burst site. The SPR is a bare, cylindrical, enriched-uranium assembly based on the Godiva II design. (W.D.M.)

25017 TID-6303
General Atomic Div., General Dynamics Corp., San Diego, Calif.
REFLECTOR ALBEDOS AND THEIR USE IN SIMPLE REACTIVITY-LIFETIME CALCULATIONS. A. J. Goodjohn, J. M. Stein, and H. A. Vieweg. Feb. 2, 1960. 31p. Project No. 40. Contract AT(04-3)-187. (GAMD-1268; MGCR-RP-156). OTS.

It is pointed out that reactivity-lifetime calculations made by using some form of thermal neutron balance equation involving the factors, η, ϵ, ρ, and f, and various nonleakage probabilities often result in serious errors. The errors are shown to be particularly evident for small reactors with efficient reflectors. A method which employs reflector albedos for determining the effect of a reflector on the core in the calculation of reactivity-lifetime is described. The calculation of albedos is discussed. (C.J.G.)

25018 WAPD-TM-202
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
ART-04—A MODIFICATION OF THE ART PROGRAM FOR THE TREATMENT OF REACTOR THERMAL TRANSIENTS ON THE IBM-704. J. E. Meyer and W. D. Peterson. July 1960. 51p. Contract AT-11-1-GEN-14. OTS.

Several recent modifications of the ART program for the study of the behavior of a nuclear reactor during various thermal transients are described. The program requires a 32,000-word IBM-704 computer with six tape units. The major modifications are provision for a slip flow model and for void reactivity contribution. (auth)

25019 CNTr-6
ELEMENTI DI COMBUSTIBILE DEI REATTORI NUCLEARI. (Nuclear Reactor Fuel Elements). A. G.

Samoilov and V. S. Volkov. Translated into Italian from Atomnaya Energ. 6, 261-76(1959). 36p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 13057.

25020

HIGH TEMPERATURE CRITICAL SYSTEMS. Harry L. Reynolds (Univ. of California, Livermore). ARS (Am. Rocket Soc.) J. 30, 772-5(1960) Aug.

A facility called "Hot Box" was constructed at Jackass Flats, Nevada, to be used in studies of high-temperature critical assemblies of simple geometry, in order to determine whether calculation procedures are adequate for estimating the effect of temperature changes. Uranium foils of 2-mil thickness and moderator blocks are assembled at room temperature and raised to higher temperatures by hot gas; the critical mass at one particular temperature is determined. Data are presented for graphite-moderated bare-unreflected and reflected systems at temperatures up to 1200°F and should be useful for nuclear propulsion system calculations. (D.L.C.)

25021

INSTRUMENTATION AND CONTROL OF NUCLEAR POWER PLANTS. C. F. Obermesser (Westinghouse Electric Corp., [Pittsburgh]). Chem. Eng. Progr. 56, 60-5 (1960) Sept.

The basic problems and principles involved in the control and instrumentation of closed-cycle water-cooled reactor power plants are discussed. The various aspects of nuclear power plant operations were examined in developing a supersafe control system. Requirements for safe reactor startups are given. Control under normal and abnormal operating conditions was studied. Design criteria to insure reliable protection against accidents are included. (M.C.G.)

25022

STABILITY INVESTIGATION OF A BOILING HEAVY WATER REACTOR. Hiroshi Nishihara and Hideaki Nishihara (Kyoto Univ.). J. Atomic Energy Soc. Japan 2, 451-9 (1960) Aug. (In Japanese)

The stability of a boiling heavy water reactor is studied by the frequency response method. The reactor type is analogous to that of the Halden Boiling Water Reactor (HBWR). For the most part, the sample reactor is based on the published design of HBWR. Sinusoidal neutron distribution along the axial direction and uniform distribution in the radial direction are assumed. The linearized power-reactivity feedback function first developed by E. S. Beckjord et al. is modified and applied. The power-reactivity transfer functions of the models with metallic uranium and UO_2 loadings are calculated for various operational conditions to investigate the stability. It is concluded that the UO_2 loading is quite stable under the assumed conditions and the metallic uranium loading can also be made stable at very high power. (auth)

25023

IMPROVEMENTS RELATING TO ELECTRIC MOTOR CONTROL MEANS FOR NUCLEAR REACTORS. Alexander Thornton Robertson and John Warren Hibbert (to A. Reyrolle and Co., Ltd.). British Patent 836,975. June 9, 1960.

A control mechanism for moving control rods in and out of the reactor core by electric motors has been invented in which each motor has two or more separate windings supplied from a corresponding number of generators, each capable of producing full control of rod movement. Each motor's generator has a regulating means to enable all the motor windings to be supplied simultaneously and in synchronization. A diagram of a 3-motor mechanism is given. (D.L.C.)

25024

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. John Shaw Hollings (to Rolls-Royce Ltd.). British Patent 842,329. July 27, 1960.

A unique fuel element for gas-cooled graphite-moderated reactors was designed using a single thin sheet of clad uranium rolled into a spiral, layers of which are held in position by brazed spacer rods of inert material. The advantages of such a fuel element are easy fabrication and high heat-transfer rates. Typically, the sheet may be 0.022-in. thick, including the coating which may be 0.003-in. thick. This fuel-element design is used in reactors having spiral graphite elements to eliminate neutron streaming (see Patent Serial No. 842,330). (D.L.C.)

25025

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. John Shaw Hollings (to Rolls-Royce Ltd.). British Patent 842,330. July 27, 1960.

A gas-cooled graphite-moderated reactor was designed to prevent neutron streaming by positioning graphite spiral elements at each end of the core bores for fuel elements. The spiral elements have helical grooves which permit the passage of coolant but stop the passage of neutrons traveling in straight lines. This reactor design uses fuel elements of the spiraling sheet type (see Patent Serial No. 842,329). (D.L.C.)

25026

IMPROVEMENTS IN AND RELATING TO RADIATION SHIELDS FOR NUCLEAR REACTORS. Alan Jackson (to C. A. Parsons and Co., Ltd.). British Patent 843,368. Aug. 4, 1960.

Shield plugs for standpipes can be made so that radiation hazards from removing or replacing plugs can be eliminated without the necessity of a thick, heavy mobile shield. This is done by lining the plug end face disposed toward the reactor with a layer containing boron or lithium. (D.L.C.)

25027

HOMOGENEOUS NUCLEAR REACTOR. (to North American Aviation, Inc.). British Patent 843,650. Aug. 4, 1960.

A homogeneous reactor of the "water boiler" type is designed in which radiolytic H_2 and O_2 are recombined catalytically at low pressure and returned to the core. Since a carrier gas is not used and the pressure is low, being equal to the sum of the solution vapor pressure and the radiolytic gas pressures, the reactor operation is greatly simplified and explosions are prevented. Further, the radiolytic gases enhance the negative temperature coefficient of reactivity in the reactor. The reactor comprises a water-boiler reactor core filled with UO_2SO_4 solution and connected to a recombiner that consists of inner and outer cylinders with platinized alumina catalyst supported on a mesh screen. The recombiner also contains a pressure transducer to measure pressure buildup. Two such recombiners, one for high and another for low flux levels, gave excellent performances in tests with water-boiler mockups of equivalent reactor powers of 5.4 kw and 8 to 400 w, respectively. (D.L.C.)

25028

"METHOD OF SCREENING-OFF THE RADIATION FROM NUCLEAR REACTORS." Kurt Diebner. British Patent 843,730. Aug. 10, 1960.

An arrangement for screening-off the gamma and neutron radiation from reactors, which has none of the disadvantages of concrete shields, was devised. The method consists of filling a hollow structure surrounding the reactor with a hydrogeneous fluid (e.g., water) and pieces of metal tubing of high molecular weight (e.g., lead). In this way a quasi-homogeneous assembly of hydrogeneous and high-molecular-weight materials is established, and the heat generated by radiation can be utilized by heat exchangers. The lengths of the tubing pieces are usually equal to their outside diameter and their thickness/outside diameter ratio is 1/9. A configuration is presented in which there are two hollow annular spaces filled with the fluid and tubing pieces. (D.L.C.)

25029

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Dennis William Ginns and Harold Howard Gott (to United Kingdom Atomic Energy Authority). British Patent 843,761. Aug. 10, 1960.

A means of support was devised for fissionable material in gas-cooled reactors whereby the material, enclosed as rods in finned canning, lies horizontally on moderator rails in cooling channels. The advantage of such a support is that the fins are free of mechanical stresses and hence may be made out of light-gage sheet or wire. (D.L.C.)

25030

IMPROVEMENTS IN OR RELATING TO FAULT DETECTION APPARATUS FOR NUCLEAR REACTORS. Michael Carl Hartnell-Beavis (to General Electric Co., Ltd.). British Patent 843,973. Aug. 10, 1960.

A sensitive fault-detection apparatus of the precipitation chamber type was designed for gas-cooled reactors. It is comprised of a cylindrical two-section chamber, one section being large for the coolant inlet and the other being small and containing the outlet. A moving wire or tape is maintained at a negative potential to collect positive ions formed by β decay of fission products. After the tape traps the ions, it moves into a counter where faults (e.g., failed fuel elements) can be detected. A filter at the inlet stops all but the uncharged gaseous atoms. The advantages of this apparatus over conventional ones are that the volume of the chamber can be kept small, thereby reducing the pressure vessel size, and that the volume of gas near the counter can be kept small without decreasing the sensitivity, thereby keeping the background count to a minimum. (D.L.C.)

25031

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to Siemens-Schuckertwerke Aktiengesellschaft). British Patent 844,475. Aug. 10, 1960.

An improved cooling circuit was invented for heterogeneous reactors in which one liquid is used as coolant and moderator; it is improved in the sense that only a portion of the liquid is directed into the moderator space, the rest going into the coolant channels. This splitting of the liquid flow into the reactor is accomplished by a branch duct which has a cooling device for increasing the moderating capacity of the liquid. The cooling circuit is designed so that modifications are possible which allow the liquid emerging from the moderator space to enter (1) the outlet, (2) the coolant channels with the rest of the liquid, and (3) the coolant channels alone with the rest of the liquid being blocked. (D.L.C.)

25032

IMPROVEMENTS IN OR RELATING TO SEALING VALVES FOR GAS CONTROL. Walter Max Lowe and Frederick Squirrell (to Thermo-Technical Development, Ltd.). British Patent 844,538. Aug. 17, 1960.

A gas valve was designed for gas-cooled reactors in which the disadvantages of conventional high- and low-pressure valves are avoided. The valve comprises a gas-tight swivel or hinged valve having two sealing elements which are a diaphragm on the pressure side and seating means for the diaphragm. These two sealing elements are designed so that a seating for the diaphragm is secured free from any sudden changes of level between the valve body and the valve, thereby avoiding bending stresses on the diaphragm which may lead to its permanent distortion. This valve is suitable for sealing ducts of comparatively large cross section carrying gas under pressure. (D.L.C.)

25033

IMPROVEMENTS RELATING TO NUCLEAR REACTORS. Peter Raymond Joseph French (to British Thomson-Houston Co., Ltd.). British Patent 844,605. Aug. 17, 1960.

A new design is proposed for gas-cooled reactor fuel elements in which the U part is fabricated in the shape of a tube with fins. The whole is canned with a protective coating (e.g., aluminum). The advantages of such elements over conventionally finned uranium solid rods and uranium tubes are that the temperature gradient in the element is kept low, the surface exposed to the coolant is large, a long path in uranium is presented to neutrons leaving or entering the element, the surface resonance absorption of neutrons is reduced because neutrons arriving at an oblique angle will pass through several fins, and the fins increase coolant turbulence. Three configurations of the fins are possible. These configurations are radial fins, helical fins, and longitudinal fins with a slight twist. The bore of the tube may be canned or its ends simply plugged. (D.L.C.)

25034

IMPROVEMENTS IN OR RELATING TO PRESSURE VESSELS FOR NUCLEAR REACTORS. Stanley Hackney (to United Kingdom Atomic Energy Authority). British Patent 845,305. Aug. 17, 1960.

A pressure vessel scheme is outlined for reactor-propelled ships. It consists of a vertical cylindrical vessel supported on the lower side by a perforated conical skirt and on the upper side by a skirt designed for free axial expansion and restrained tilting movement. Other details of the vessel (e.g., its thermal and biological shields) are given. (D.L.C.)

25035

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR MODERATOR STRUCTURES. William Rodwell (to United Kingdom Atomic Energy Authority). British Patent 845,306. Aug. 17, 1960.

A graphite-moderated configuration was invented which is strong enough for use in reactor-powered ships and which is partly compensated for by Wigner growth. The moderator structure comprises uniform graphite blocks positioned in layers with minimum Wigner growth properties in the direction of their lengths and layers of graphite tiles alternating with the layers of blocks. The tiles are so arranged that each tile has minimum Wigner growth properties perpendicular to both the block lengths and the direction of minimum Wigner growth in adjacent tiles. In one typical configuration, the blocks are 9 × 8.5 × 31.2 in. and the tiles are 9-in. cubes. After irradiation, the side faces of the tiles remain in contact and their axes move apart by an amount equal to half the sum of minimum and maximum growths. The blocks are prevented from becoming wider than the tiles by the fact that maximum growth occurs on the 8.5-in. side only. Means are also provided for keying the tiles to the blocks and for preventing coolant leakage from the channels. (D.L.C.)

25036

IMPROVEMENTS IN OR RELATING TO FUEL ELEMENT DISCHARGE SYSTEMS FOR NUCLEAR REACTORS. Everett Long (to United Kingdom Atomic Energy Authority). British Patent 845,456. Aug. 24, 1960.

A means of discharging fuel elements from sodium-cooled graphite-moderated reactors is described in which the discharge machine, which is movable over the top face of the reactor and which forms part of the radiation shielding, has a channel for transferring fuel elements to a remote point below the reactor without opening the shielding. One particular reactor configuration provided with such a discharging means is given together with a discussion of its operation. (D.L.C.)

25037

IMPROVEMENTS RELATING TO NUCLEAR REACTORS. John Anthony Wynne Huggill (to A.E.I.-John Thompson Nuclear Energy Co., Ltd.). British Patent 845,469. Aug. 24, 1960.

A gag (flow regulator) for gas-cooled reactors is designed which is removable and yet is not blown out of the fuel channel by the gas pressure, especially during fuel element charging and discharging. The gag, placed at the bottom of a fuel element channel, comprises outer and inner members, the former being fixed permanently to the channel and the latter being removable by releasing a latch-notch interlocking arrangement; thus, it can be replaced with another gag of different size. (D.L.C.)

25038

IMPROVEMENTS IN OR RELATING TO PRESSURE VESSELS. Geoffrey Hilton and Denis Roland Chambers Guttery (to United Kingdom Atomic Energy Authority). British Patent 845,593. Aug. 24, 1960.

Pressure vessels for graphite-moderated reactors can be constructed with closely spaced access holes by forming part of it, usually its top, as a deep box grid sealed by a mild steel membrane with access pipes. In this way, an access point can be provided for each fuel element and control rod, thus eliminating the need for a manipulating machine and an increase in pressure vessel size. (D.L.C.)

25039

ART OF COOLING AND MODERATING NEUTRONIC REACTORS. (to U. S. Atomic Energy Commission). British Patent 845,666. Aug. 24, 1960.

Monoisopropylbiphenyl (IPBH) is preferable to biphenyl as a reactor coolant and moderator because of its lower freezing point (−47°C vs. + 70°C). IPBH can be synthesized by alkylating biphenyl with propylene and using $AlCl_3$ as catalyst. A specific synthesis procedure is given for obtaining 32 lb of IPBH from 80 lb of biphenyl. The effects of 1.6-Mev neutron irradiation on the properties of IPBH were studied for fluxes of 1.6×10^{11} neutrons/cm^2/sec for >110 days. If IPBH is employed in a hydrocarbon mixture for reactor purposes, it exerts a beneficial effect since it reacts with radioinduced radicals to form a hydrocarbon and IPBH radicals. However, because IPBH is readily oxidized, O_2 must be eliminated from reactor systems using IPBH. A method is described for removing contaminated scale and impurities from steel or iron systems prior to use with IPBH. A power reactor using IPBH as moderator and coolant is illustrated diagrammatically, and IPBH is compared with biphenyl with reference to moderating effectiveness, specific heat, and melting point. Only in the respect of viscosity is IPBH inferior to biphenyl; however, a mixture of IPBH and biphenyl can remedy this defect. (D.L.C.)

25040

IMPROVEMENTS IN OR RELATING TO ELEMENTS OF FISSIONABLE MATERIAL. (to Escher Wyss Aktiengesellschaft). British Patent 845,804. Aug. 24, 1960.

A fuel element was designed which makes possible an increase in the maximum temperature of the cyclic process of conversion of nuclear energy into useful energy and, hence, of its efficiency. It comprises agglomerates of fissionable material in the space between two concentric tubular bodies having radial aperatures, the whole assembly being placed within a cylinder which is surrounded by a moderator. The gaseous coolant enters the cylinder outside the tube and diffuses through the radial aperatures into the space between the tubes where it contacts the fuel; it then diffuses toward the center and is discharged from the cylinder. The advantage of such a fuel element aside from the higher temperatures is that the gas is at low temperature outside the tubes and, hence, materials having relatively low heat resistance can be employed there. The maximum temperature of the cyclic process can be increased still further, provided that the interior tube can withstand the increase. The cylinder may be constructed of zirconium or aluminum, which are resistant to CO_2 up to 500 and 450°C, respectively, and the tubes may be constructed of beryllium oxide or zirconium oxide, which are resistant to CO_2 up to 1500°C. (D.L.C.)

25041

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to Siemens-Schuckertwerke Aktiengesellschaft). British Patent 845,805. Aug. 24, 1960.

A heterogeneous reactor moderator and coolant circuit was invented to separate the two fluids by an inert gas, keeping the gas at the required pressure without pumps or valves by means of the operating and static coolant pressure. The gas forms a protective zone between one of the fluids and the wall of a vessel containing the other; in cases where the gas is in direct contact with both fluids, gas-permeable walls are set up to eliminate any danger of vapors exploding. Two configurations of a reactor having the above circuit and with "U" and straight cooling tubes are given. This circuit is useful for water-moderated, liquid metal-cooled reactors because the high static pressure of the liquid metal can be used to place the gas under pressure. (D.L.C.)

25042

IMPROVEMENTS IN OR RELATING TO DEVICES FOR THE DETECTION OF INDIVIDUAL FAULTY FUEL ELEMENTS AND THE PRECISE LOCATION OF THE POSITION OF THE FRACTURE ON THE SURFACE OF THE FAULTY ELEMENT. Kenneth William Cunningham and Denis Thomas William Alaiga-Kelley (to Plessy Co., Ltd.). British Patent 846,497. Aug. 31, 1960.

A device for detecting faulty fuel elements was invented which enables the individual faulty element to be found after the channel containing the fault has been detected. The basis of the device is the examination of individual elements in a neutron flux within the biological shield; the device comprises a rotatable basket located between the pressure vessel and the biological shield. The basket contains pockets for individual fuel elements and an inlet port for coolant to pass into the pockets. In operation, the basket containing fuel elements to be examined is rotated successively under a gas-collecting pipe whereby the gas emerging from individual pockets is collected and analyzed for radioactivity. The device can also be adapted for precisely locating the damage on the faulty fuel element. (D.L.C.)

Power Reactors

25043 APAE-Memo-274
Alco Products, Inc., Schenectady, N. Y.
SM-2 FINAL DESIGN QUARTERLY PROGRESS REPORT, PHASES I AND II, [FOR] MARCH 1, 1960 TO JUNE 30, 1960. 27p. Contract DA-44-192-ENG-7.

Progress is reported on shielding analysis, primary shield design, materials technology engineering, fuel-handling tools, and plant design. (W.L.H.)

25044 BAW-1204
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
NUCLEAR MERCHANT SHIP REACTOR; GENERAL GUIDE TO SHIPPING REQUIREMENTS FOR ACTIVATED INTERNALS AND COMPONENTS. W. R. Smith. Aug. 15, 1960. 40p. Contract AT(30-3)-274. OTS.

Requirements prior to and during shipment of radioactive internals of the Nuclear Merchant Ship Reactor are discussed briefly. Sectioning plans and shipping-container weights and dimensions are given for the individual components; plots of dose rate vs. shield thickness are presented for each container. The bases are given for the sectioning of components and the specification of shielding thicknesses. (auth)

25045 CF-60-4-1
Oak Ridge National Lab., Tenn.
PROCESSING METHODS, FISSION PRODUCT POISONING AND FUEL CYCLE COSTS FOR FLUID FUEL REACTORS. W. D. Burch, D. O. Campbell, and H. W. Weeren. July 12, 1960. 46p. OTS.

The fuel cycles and fuel-cycle costs were investigated for the aqueous homogeneous, molten salt, and liquid bismuth reactors. Estimates of the fission-product and protactinium poisoning, which determines the breeding ratio and doubling time or fuel yield, were made. Potentially, each of the reactors can operate as a breeder with a useful doubling time and at comparable fuel-cycle costs probably in the range 1.0 to 1.5 mills/kwh. Generally the costs increase sharply with increasing breeding ratio and tend to decrease at lower breeding ratios, but this tendency is limited practically for the AHBR and LBBR because of increasing blanket power. This limitation does not apply to the MSBR, for which the minimum fuel-cycle cost probably occurs with a conversion ratio somewhat less than one. The AHBR is capable of the highest fuel yield with a reasonable fuel-cycle cost, and the MSBR is potentially capable of the lowest fuel-cycle cost, but not as a good breeder. Of the cost estimates for the three reactors, that for the AHBR is on the firmest basis, the others being based largely on laboratory data. (auth)

25046 CF-60-7-81
Oak Ridge National Lab., Tenn.
CRITICALITY IN THE HRT TRANSFER VESSEL. S. Jaye and L. L. Bennett. July 26, 1960. 7p. OTS.

The possibility of a criticality accident in transferring irradiated fuel solution from the Homogeneous Reactor Test was investigated. The vessel (a cylinder $19^{1}/_{4}$ in. in dia., $30^{1}/_{2}$ in. high, and shielded with 9 in. of lead) will be loaded with 100 liters of solution containing 8 kg of enriched uranium and 250 g of gadolinium. The infinite multiplication constant (k_∞) obtained in the solution is less than unity when the uranium is uniformly distributed. However, if the uranium were to settle, k_∞ exceeds unity when the concentration is 180 g uranium/liter. Although there is a corresponding increase in the effective multiplication constant initially, a maximum value of 0.86 is achieved when the uranium concentration reaches 400 g/liter. (auth)

25047 CRL-64
Atomic Energy of Canada Ltd., Chalk River, Ont.
NUCLEAR POWER IN CANADA. J. G. Melvin. Aug. 1960. 32p. (AECL-1063). AECL.

Presented at the Conference on Medium and Small Power Reactors, International Atomic Energy Agency, Vienna, September 5-9, 1960.

The Canadian program is outlined, and some features of the NPD-2 power reactor are described. Low fueling costs make heavy-water-moderated reactors particularly suitable for power outputs of 200 Mw or more; reasons are given for expecting reductions in the minimum economic size. At the other end of the scale, small enriched reactors for remote areas were studied. Their economic feasibility is strongly influenced by external factors. The importance of supporting facilities to a nuclear power project is discussed. (auth)

25048 CWAED-37
Canadian Westinghouse Co., Ltd. Atomic Energy Div., Hamilton, Ont.
SMALL REACTORS FOR NORTHERN CANADA. May 1960. 75p. For Atomic Energy of Canada Ltd. (AECL-1045). AECL.

Nuclear power plants appropriate for Northern Canada were studied and their costs estimated. Cost data are provided for pressurized-water-reactor (PWR) and boiling-water-reactor (BWR) plants ranging in size from 2 to 40 Mw(t). The cost of the most economical, combination of nuclear and oil-fueled equipment to supply heat and power to Frobisher Bay is determined. It is concluded that the BWR plants have lower initial and annual costs than the PWR plants and that conventional plants are more economical in the power range studied. (W.D.M.)

25049 DLCS-364
Duquesne Light Co., Shippingport, Penna. and Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
SHIPPINGPORT OPERATIONS FROM START-UP TO FIRST REFUELING, DECEMBER 18, 1957 TO OCTOBER 7, 1959. John E. Gray, William H. Hamilton, and William E. Wynne, eds. 342p. OTS.

A summary of information gained from the operation of the Shippingport Power Station during the life of the first seed of the first core is presented. The experience with the nuclear portion of the station is emphasized, and the conventional portion is discussed only as it relates to over-all station operation or unusual problems arising as a result of conventional equipment used with a pressurized water reactor. (J.R.D.)

25050 DP-505
Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.
HEAVY WATER MODERATED POWER REACTORS PROGRESS REPORT [FOR] MAY 1960. R. R. Hood and L. Isakoff, comps. July 1960. 76p. Contract AT(07-2)-1. OTS.

A Zircaloy-clad tube of unalloyed uranium that was irradiated in a loop of the NRU reactor to a maximum exposure of 950 Mwd/ton at a maximum uranium temperature of 400°C experienced less than 1.5% volume increase and 0.14% outer-cladding strain. Inspection of the swaged oxide tube that had failed during irradiation in a Savannah River reactor revealed that a 9-in.-long crack of as-yet-unknown origin had developed in the outer stainless-steel cladding of the tube. Transient calculations showed that boiling D_2O reactors that are fueled with uranium metal probably would not operate stably as presently designed, but that those fueled with uranium oxide operating at high fuel temperature probably would be stable. A computer code for the calculation of the lattice bucklings of D_2O-moderated reactors is described. A description is presented of the tandem-extrusion process that was developed for the fabrication of bonded joints of Zircaloy and stainless steel. (For preceding period see DP-495.) (auth)

25051 GA-1441
General Dynamics Corp. Electric Boat Div., Groton, Conn.
MGCR HEAT EXCHANGER TEST PROGRAM. Interim Report [on] ISOTHERMAL AIR AND HELIUM TESTS. L. M. Casellini and H. C. Paulsen, II. Oct. 1959. 58p. OTS.

The Maritime Gas-Cooled Reactor (MGCR) project is engaged in the design of a closed-cycle gas-turbine propulsion plant utilizing a helium-cooled nuclear reactor as the heat source. The cycle employs a counterflow shell-and-tube regenerator to attain a high thermodynamic cycle efficiency. A heat exchanger test program was designed to compile and correlate sufficient experimental data for the aerodynamic and thermal design of the prototype regenerator. A test facility was erected for this study. The model heat exchanger is similar in configuration to the prototype unit. Results of the isothermal air and helium pressure-drop tests are presented. The friction factor of bare tubes and the performance of a low-pressure-drop foil-shaped tube support are included. Parameters are defined and graphs are included to describe the pressure drop phenomena at heat exchanger entrance, exit, and U-bend. The correlated data, representing approximately 700 individual runs, cover a range of Reynolds number from 25,000 to 500,000. (auth)

25052 GEAP-0878
Commonwealth Edison Co., Chicago and General Electric Co. Atomic Power Equipment Dept., [Schenectady, N. Y.].
ENCLOSURE SECTION OF THE HAZARDS SUMMARY REPORT FOR THE DRESDEN NUCLEAR POWER STATION. R. C. Thorburn, C. A. Pursel, and G. Sege. Jan. 24, 1957. Revised June 3, 1957. 70p. OTS.

The general design features of the gas-tight spherical steel enclosure (190 ft in dia.) that houses the reactor and its associated equipment are described. The bases on which these features were selected are outlined. The reactor system, enclosure type and size, basis of internal pressure, meteorological and seismological allowances, leakage, location, construction, and testing sequence are discussed. (W.D.M.)

25053 GEAP-1044
Commonwealth Edison Co., Chicago and General Electric Co. Atomic Power Equipment Dept., [Schenectady, N. Y.].
PRELIMINARY HAZARDS SUMMARY REPORT FOR THE DRESDEN NUCLEAR POWER STATION. G. Sege. May 1, 1957. Revised June 24, 1957. 314p. OTS.

The main design features of the plant are described and analyzed from the safety standpoint. Salient design features and specific safety features are amplified in detail. It is concluded that no person on or off the plant premises will be exposed to radiation in excess of the permissible limits in any of the normal plant operation, including disposal of all radioactive materials produced. (W.D.M.)

25054 GEAP-2071
Commonwealth Edison Co., Chicago and General Electric Co. Atomic Power Equipment Dept., [Schenectady, N. Y.].
OPERATING PROCEDURES AND EMERGENCY PLANS FOR THE DRESDEN NUCLEAR POWER STATION. June 5, 1958. 103p. OTS.

The operating procedures proposed to promote the safety of all phases of plant operation and the emergency plans that would be followed if an accident occurred by which a significant radiation hazard was created are summarized and evaluated. Operating principles are amplified and procedural information, plans, and analyses relevant to the safe operation of the plant and protection of the public are given. (W.D.M.)

25055 GEAP-3009
Commonwealth Edison Co., Chicago and General Electric Co. Atomic Power Equipment Dept., [Schenectady, N. Y.].
AMENDMENT NO. 1 TO PRELIMINARY HAZARDS SUMMARY REPORT FOR THE DRESDEN NUCLEAR POWER STATION. May 26, 1958. 103p. OTS.

Modification of the control rod drives from electromechanical-hydraulic to completely hydraulic system, revisions to the reactor safety system, refinements in the reactor physics data, and effects of these changes on the safety analyses are discussed. Answers on specific safety questions posed by the AEC are given. (W.D.M.)

25056 GEAP-3053
Commonwealth Edison Co., Chicago and General Electric Co. Atomic Power Equipment Dept., [Schenectady, N. Y.].
AMENDMENT NO. 2 TO PRELIMINARY HAZARDS SUMMARY REPORT FOR THE DRESDEN NUCLEAR POWER STATION. D. P. Ebright. Aug. 22, 1958. 21p. OTS.

Revisions to certain portions of Amendment No. 1, reflecting refinements in reactor physics data and the analysis of certain hypothetical reactor accidents, are given. Additional information is presented on start-up and coolant-loss accidents and on one of the fuel model heat-transfer functions. (W.D.M.)

25057 GEAP-3076
Commonwealth Edison Co., Chicago and General Electric Co. Atomic Power Equipment Dept., [Schenectady, N. Y.]
AMENDMENT NO. 3 TO PRELIMINARY HAZARDS SUMMARY REPORT FOR THE DRESDEN NUCLEAR POWER STATION. J. L. Murray and D. P. Ebright. Dec. 23, 1958. 117p. OTS.

Revisions are made to the Preliminary Hazards Summary Report on the sections relating to technical summary, general description of the process, description of the plant, nuclear characteristics of the reactor, waste disposal, operation, and safety analysis. Information is presented to clarify specific points in the operating procedures and emergency plans. (W.D.M.)

25058 GEAP-3106
Commonwealth Edison Co., Chicago and General Electric Co. Atomic Power Equipment Dept., [Schenectady, N. Y.]
PART I, AMENDMENT NO. 4 TO THE PRELIMINARY HAZARDS SUMMARY REPORT FOR THE DRESDEN NUCLEAR POWER STATION. D. P. Ebright. Feb. 3, 1959. 27p. OTS.

Revisions are presented to data on the control-rod system, nuclear characteristics of the reactor, and core-flux monitor system. Additional data on enclosure negative pressure considerations are given. Revisions to the operating procedures and emergency plans are made. (W.D.M.)

25059 HW-63585, HW-65074
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EGCR LATTICE RADIAL AND ANGULAR POWER DISTRIBUTION [1.8 w/o ENRICHMENT]. P. F. Nichols.

Jan. 19, 1960. 5p. EGCR LATTICE RADIAL AND ANGULAR POWER DISTRIBUTION 2.6 w/o ENRICHMENT. P. F. Nichols. May 10, 1960. 6p. Contract W-31-109-Eng-52. OTS.

These two reports were issued separately, but are cataloged as a unit.

Detailed flux traverses were made of the Experimental Gas Cooled Reactor lattice in the Physics Constants Test Reactor to obtain data needed to solve the problem of bowing in the outer six rods of the seven-rod cluster. Uranium dioxide fuel enriched to 1.8 and 2.6 wt.% was used in the measurements. (W.D.M.)

25060 IDO-28545
Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM MONTHLY PROGRESS REPORT FOR SEPTEMBER 1959. Oct. 31, 1959. 66p. Contract AT(10-1)-880. OTS.

The Army Gas-Cooled Reactor Systems Program includes a water-moderated, heterogeneous reactor (GCRE-I); a graphite-moderated, homogeneous reactor (GCRE-II); a mobile, gas-cooled reactor power plant (ML-1); and the Gas Turbine Test Facility. The progress of each project, its associated tests and data evaluation, the applicable design criteria, and the fabrication of reactor components are reported. (See also IDO-28542.) (W.D.M.)

25061 IDO-28546
Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM MONTHLY PROGRESS REPORT FOR OCTOBER 1959. Nov. 30, 1959. 61p. Contract AT(10-1)-880. OTS.

25062 IDO-28557
Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM MONTHLY PROGRESS REPORT FOR MAY 1960. June 30, 1960. 99p. Contract AT(10-1)-880. OTS.

25063 IDO-28558
Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM SEMIANNUAL PROGRESS REPORT [FOR] JANUARY 1–JUNE 30, 1960. July 31, 1960. 218p. Contract AT(10-1)-880. OTS.

Gas Cooled Reactor Experiment I. Expedient modifications to the tube bundle and control rods made possible the attainment of initial critical of the GCRE-I reactor early in February. The scheduled series of low-power experiments was completed and the facility shut down in mid-April to permit the permanent modification to the tube bundle, control rods, and instrumentation. Gas Cooled Reactor Experiment II. Work on the GCRE-II was limited to materials development and systems studies. These studies included mobile and portable power systems using homogeneous graphite reactors as well as modifications and improvements to the ML-1 system. The materials development effort was devoted to homogeneous graphite fuel materials. The ML-1. Activation measurements were made in the Lid Tank Facility. Reanalysis of stresses in the tube sheet indicated high stresses in certain regions. Design of most of the reactor package was completed and fabrication initiated. An alloy (80% Ag–15% In–5% Cd) was selected for the ML-1 control blades on the basis of ductility tests, corrosion tests, and neutronic calculations. A critical experiment was performed on the ML-1 configuration with pin type fuel elements. The recuperator design selected is a four-pass shell and tube heat exchanger. Fuel-element Development. A preliminary design study indicated that the seven-pin fuel element does not significantly improve performance over that obtainable with the 19-pin design. A corrosion test specimen of Hastelloy X exposed for 5000 hr in air at 1750°F showed 0.0016-in. penetration. Beryllium oxide–uranium oxide capsule irradiation was completed with about 2 at. % U^{235} burn-up at maximum surface temperature of 1740°F. The IB-2T-Z irradiation test was completed after about 800 hr of operation, including 1147 thermal cycles between 1000 and 1600°F without any evidence of malfunction. The irradiation of the GCRE-1 plate type element (1-3P) was completed after 429 hr of operation. (For preceding period see IDO-28549.) (W.L.H.)

25064 MND-MPR-1833
Martin Co. Nuclear Div., Baltimore.
MARTIN DESIGN REPORT — SKID MOUNTED MARTIN POWER REACTOR, 1000 KW SYSTEM. Apr. 1959. 354p. Contract DA-44-009-Eng-3635.

Analytical data on the nuclear, shielding, and component aspects are presented. The equipment, design, installation, and testing are described. The maintenance and refueling program and the design engineering performed to adapt the basic system to the required load requirements are discussed. Cost estimates for installation and testing at the site and engineering drawings are given. (W.D.M.)

25065 NASA-TN-D-288
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
NASA RESEARCH ON THE HYDRODYNAMICS OF THE GASEOUS VORTEX REACTOR. Robert G. Ragsdale. Sept. 1960. 42p. OTS.

Presented before a closed session of the annual meeting of the American Rocket Society, Washington, D. C., Nov. 16-21, 1959.

A gaseous nuclear reactor utilizing a vortex type flow field to increase the heavy-element holdup time is considered. Equations describing the separation mechanism are presented for both ideal (inviscid, laminar) and real (viscous, turbulent) fluid conditions. Analytical results are given for the separation of air-bromine mixtures in an experimental vortex test apparatus. (auth)

25066 NP-9113
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
PROPERTIES OF SOME PLUTONIUM FUELS. D. M. Poole, J. K. Critchley, J. A. C. Davidson, P. M. French, E. N. Hodkin, and M. J. F. Notley. [1960]. 44p.

[Presented at the] International Conference on the Metallurgy of Plutonium, Grenoble, France, April 19-22, 1960.

Alloys of plutonium in Fe, Zr, Th, U, and U–Mo that are possible reactor fuel materials were examined for their oxidation behavior in air up to 500°C and carbon dioxide up to 800°C; compatibility of the ternary U–Mo–Pu alloys with stainless steel was investigated in the temperature range 600 to 650°C; hardness figures for the binary and ternary alloys at room and elevated temperatures are reported. Some PuO_2 cermets stable up to 1400°C are described. Low-melting ternary alloys of the Pu–Co–Ce type were examined for physical properties and compatibility with container materials. The oxidation of pure δ-phase plutonium in air was also studied. (auth)

25067 ORNL-2964
Oak Ridge National Lab., Tenn.
GAS-COOLED REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1960. Aug. 22, 1960. 275p. Contract W-7405-eng-26. OTS.

Design Investigations: The effects on the power distribution of operating the EGCR without experimental fuel assemblies installed in all eight in-pile loops were investigated. The effects on the EGCR power distribution of inserting control rods in various patterns were studied. The nonuniform neutron absorption on the surface of EGCR control rods was investigated. Neutron-spectrum calculations were carried out for several moderator temperatures and absorption cross sections in order to determine for graphite-moderated systems the adequacy of the usual approximation of the spectrum as the sum of a Maxwellian distribution and a 1/E distribution terminated at the low energy end by a suitable joining function (or functions). A series of calculations was started to explore the nuclear characteristics of two-region, semihomogeneous, gas-cooled, BeO-moderated reactors in which the fissionable material ($U^{233}O_2$) is in a central cylindrical core and the fertile material (ThO_2) is entirely in a surrounding blanket. The Title II design of the EGCR fuel assembly was completed. An analysis was made of the nominal-maximum fuel-element surface temperature as a function of the channel mixed-mean gas temperature and the maximum channel exit-gas temperature for one mode of control of EGCR operation. Heat-transfer data for rod clusters were analyzed, and a correlation of the average heat-transfer coefficient with Reynolds number and axial position was established. A mathematical model was developed for studying shifting of the coolant stream as it moves along a rod in order to predict the temperatures of the parallel streams as they progress through the reactor. A fuel-element life code developed for computing the internal temperature structure, the amount of fission gas released, the internal pressure, the cladding strain when the internal pressure exceeds the coolant pressure, and the creep damage was used for comparing top-loading and inverted-loading fuel programs for the EGCR. A statistical method was developed for estimating the probability that the hot spot on the EGCR fuel element will exceed a given temperature. A method of cooling the EGCR control rods was developed that will minimize diversion of coolant flow through leakage paths between graphite blocks. A preliminary design of a control rod cooled by this method was developed. Means for reducing the thermal stresses in the top head nozzles of the EGCR pressure vessel were studied. The stresses in the graphite sleeves of the EGCR fuel elements were calculated, and the maximum stress was found to be within the allowable limit. A study was made of the thermal stresses in the EGCR pressure-vessel support skirt, and a satisfactory design was developed. Procedures for removing ruthenium and cerium contamination from steel were outlined and incorporated in procedures for decontaminating the EGCR charge and service machines. Experimental information was obtained on the thermal characteristics of the specified EGCR fuel cluster. The effect of relative orientation of adjacent clusters on the heat-transfer distribution in the downstream element was studied by means of mass-removal measurements on naphthalene-coated rods. Velocity distributions in the downstream element of two adjacent EGCR-type clusters were determined with Title I H-bar, Title II cylindrical, and Title II conical spiders at various relative orientations. Materials Research and Testing: The recycling of scrap produced during the fabrication of UO_2 pellets for fuel elements was studied. The expansion of UO_2 pellets with "dished ends" was measured and found to be about 10% less than that of standard flat-end pellets at high temperatures. Studies of fission-product release upon heating of UO_2 specimens previously irradiated at low temperatures were continued. Efforts to develop high-density, low-porosity graphite were continued, and graphite bodies with fired densities as high as 2.0 g/cm^3 were formed. The reaction of UO_2 with graphite was studied over a range of temperatures, particle sizes, and pressures. In studies of the mechanical properties of graphite, tensile tests were run at room temperature and at 750°F, and incremental loading tests were performed at 78, 750, and 1100°F. The conditions required for shape-casting of small-diameter rods of UC in copper molds were determined. The creep testing of type 304 stainless steel was continued, and the results substantiated the previous data. In the study of the reactions of type 304 stainless steel with CO-CO_2 mixtures, the exposure of thin-walled type 304 stainless steel to a mixture of CO and CO_2 showed that carburization depends on the CO-to-CO_2 ratio and that it may be controlled. The effects of oxygen, nitrogen, and hydrogen on the mechanical properties of columbium were studied in bend tests and tensile tests at room temperature and at high temperatures. The nil-ductility transition temperature of as-received type SA-212, grade B, steel plate was determined in drop-weight tests on 4-in.-thick specimens to be 10°F at the surface and 30°F at the midsection. The fabrication and inspection of 50 prototype EGCR Title I fuel elements were completed. A remote-welding technique is being developed for welding of the EGCR experimental loops. A full-size mockup of one quadrant of a burst-slug-detection tube nozzle and a mockup of the thermocouple penetrations were fabricated to confirm the procedures developed previously. The oxidation of beryllium in CO_2 at a pressure of 1 μ was investigated, and oxidation-rate equations were formulated. In tests of the compatibility of beryllium with stainless steel in a NaK environment, the transfer of beryllium to form NiBe on the surface of the stainless steel was very slight at 600°C, but a 0.010-in. layer of NiBe was formed at 800°C. Several brazing alloys suitable for joining beryllium were developed. Irradiation of eight full-diameter EGCR prototype group II fuel capsules was continued. In the miniature capsule fission-gas-release experiments, irradiation of assembly L-25ab was completed and irradiation of assembly L-28ab was started. Measurements were made of the fission gas evolved by miniature capsules irradiated at maximum central UO_2 temperatures in the range 2750 to 3300°F. Examinations of the fueled-graphite experimental assembly that was irradiated in the MTR were made. Two UO_2 samples encased in siliconized silicon carbide-coated graphite are being irradiated in the ORR closed-cycle loop. After irradiation for more than 400 hr at 1800°F there has been no increase in fission-product activity of the coolant. A study of the release of iodine from the high-density UO_2 being irradiated in the ORR instantaneous fission-gas release experiment indicated that iodine release has the same temperature dependence as that of the release of xenon and krypton. The first high-temperature beryllium-irradiation experiment was terminated after a fast-neutron exposure of 7×10^{19} neutrons/cm^2 rather than the planned exposure of 10^{21} neutrons/cm^2 because of the failure of furnace circuits. Compatibility tests of graphite, structural materials, and helium have demonstrated that in a reactor system such as the EGCR the area of metal surface exposed at temperatures approximating the exit-gas temperature will have an important bearing on the corrosion behavior of the hotter fuel cladding. Tests of two high-pressure thermal-convection loops containing helium, AGOT-grade graphite, metal test specimens, and a dummy fuel element assembly were completed. A small-scale gas-purification system of the type proposed for use with the EGCR coolant system was installed on the forced-circulation loop. In the experimental studies of the degassing behavior of graphite, several specimens prepared from needle coke, a highly purified AGOT-grade sample, a low-permeability specimen, and a coated specimen were tested. Experimental studies of the interdiffusion of argon and helium through an AGOT reactor-grade graphite septum under uniform total-pressure conditions were continued, and an unexpected drift of molecules was observed. The chemical behavior of fission products in fissioning UO_2 was studied. Methods of removing fission-product gases from the coolants of gas-cooled reactors were investigated. A thermal-conductivity apparatus was developed for chemical analyses of mixtures of helium and argon. Studies of the factors that influence the accuracy of thermocouples attached to metal surfaces in high-velocity gas streams were continued. Installation of gas-cooled in-pile loop No. 1 and its auxiliary equipment at the ORR is nearing completion. Developmental work leading to the design of the EGCR experiment loops was continued. Requirements for a hydrogen-cooled loop were developed according to the basic criteria used for the design of the helium- and CO_2-cooled loops. Design work continued on gas filters, the gas heater, loop valves, and the leak-detection system. The design of the reactor service machine was modified to provide for servicing the through-tubes. Design studies were continued on the coolant-cleanup system for the loops. Tests of compressors for ORR in-pile loop No. 1 were continued, and difficulties were encountered because of inadequate coolant flow. Additional data were obtained on back-diffusion through labyrinth seals. (For preceding period see ORNL-2929.) (W.D.M.)

25068 ORNL-2985
Oak Ridge National Lab., Tenn.
THE FEASIBILITY OF AN UNATTENDED NUCLEAR POWER PLANT. M. W. Rosenthal, M. M. Yarosh, C. F. Baes, Jr., and R. C. Robertson. Sept. 8, 1960. 64p. Contract W-7405-eng-26. OTS.

A study was made of the feasibility of constructing a small nuclear power plant capable of operating 1 yr completely unattended. A system which will produce 1 Mw of electricity without interruption is required for field use in about 4 yr. It is felt that the 4-yr requirement greatly restricts the opportunity for development of new concepts and new technology and that the objective is most likely to be attained by extreme simplification of a type of reactor with which there has been favorable experience. A pressurized-water reactor was selected for the application, both because of the extensive experience with it and because it appears readily adaptable to simplification. For example, the power plant suggested has hermetically-sealed primary and secondary systems, and all control systems, except the turbine governor, have been eliminated. It is concluded that it is feasible to develop a reliable, simplified, pressurized-water reactor system for unattended service in the allotted time. (auth)

25069 TID-6377
Duquesne Light Co., Shippingport, Penna.
MONTHLY OPERATING REPORT [FOR] MAY 1960. 30p. Contract AT(11-1)-292. OTS.

The station was shut down from May 1 to May 6 for maintenance and the completion of testing prior to initial full-power operation of Core I, Seed 2. The station operated at full power for the balance of the month with the exception of two safety shutdowns and one scheduled outage. The water specifications were maintained in the reactor coolant system with the exception of one daily hydrogen result of 14 cc/kg on May 2. Data were obtained for fission-product activity in the cooling system. The major contamination problem was cleaning of the fuel-handling canal deep pit. General maintenance, instrumentation modifications, test procedures, and training program are summarized. (See also TID-5944.) (W.D.M.)

25070 TID-6378
Duquesne Light Co., Shippingport, Penna.
MONTHLY OPERATING REPORT [FOR] JUNE 1960. 42p. Contract AT(11-1)-292. OTS.

The station was operated at full power from June 1 to 10. From 10 to 23 physics tests and maintenance operations were performed. The station was operated at various power levels from June 23 to 30 owing to line-current limitations. All completed data obtained from the fission-product activity in the cooling system indicated that concentration was generally lower than that measured at the end of Core I, Seed 1 life. The gross iodine activities in the secondary-system boilers showed a considerable increase. General maintenance, test procedures, and training program are summarized. (W.D.M.)

25071 TID-8528
Division of Reactor Development, AEC and Maritime Administration, Washington, D. C.
3 DESIGN STUDIES FOR SELECTING A PROTOTYPE REACTOR FOR A NUCLEAR TANKER. Summary and Evaluation Report. Sept. 1960. 73p. OTS.

These studies were conducted to review water-reactor technology to determine the relative merits of the various water-reactor propulsion concepts which could be applied to a tanker and their potential to achieve economic operation in the relatively near future. A 43,000-dwt (deadweight tons) tanker was selected as the reference vessel. Concepts investigated include PWR, BWR (indirect cycle), and BWR (direct cycle). (W.D.M.)

25072 WAPD-233
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
THE FIRST REFUELING OF THE SHIPPINGPORT ATOMIC POWER STATION. H. Feinroth and T. D. Sutter, Jr. July 1960. 277p. Contract AT-11-1-GEN-14. OTS.

Replacement of the first seed of the Shippingport Pressurized Water Reactor seed and blanket core commenced Nov. 2, 1959, after 5806 equivalent full power hours of operation. On May 7, 1960, after five months of refueling and about one month of plant checkout and testing, the reactor was returned to full-power operation. The entire refueling operation is reviewed with the objective of delineating the lessons learned and identifying action that should be taken so that future refuelings can be performed more expeditiously. (W.D.M.)

25073 AEC-tr-4184
IONIC THERMOGENERATOR. J. Casanova. Translated from French Patent No. 1, 161, 079. Aug. 20, 1958. 7p. JCL.

The ionic thermogenerator is a power generator that produces direct conversion of thermal energy from a nuclear reactor or an ordinary heat source into electric energy in the form of a high-voltage direct current. Conversion is the result of passage of strongly ionized metal vapors from a high-pressure boiler into a convergent-divergent pipe, which converts the pressure into high speed. The metal vapors then pass to a flat Venturi tube placed in a magnetic field oriented at right angles to the circulation of the vapor. Drawings referred to in the text are not included. (W.D.M.)

25074 JPRS-5024(p.76-93)
THE INFLUENCE OF SMALL ADMIXTURES ON THE

CREEP OF SOLID SOLUTIONS. V. A. Pavlov, E. S. Yakovleva, and M. V. Yakutovich. Translated from Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial No. 19, 48-(?)(1958).

The effects of metallic admixtures on alloy grain boundaries were investigated. The study was conducted on an aluminum alloy containing traces of zinc, silver, copper, or magnesium. It was found that alloying metal with admixtures forming solid solutions causes strong variations in the alloy resistance to creep. The phenomenon appears to be associated with the nonuniform distribution of the admixture and with variation of deformation distribution over the metal grain under strain. (J.R.D.)

25075

PRINCIPLES FOR THE CALCULATION OF THE CURRENT PRODUCTION COSTS OF NUCLEAR POWER PLANTS. W. Gersten, A. Herrhausen, H. Laurick, A. Stadie, and H. Stief (Studiengesellschaft für Kernkraftwerke G.m.b.H., Hanover). Atom u. Strom 6, 55-68(1960) June-July. (In German)

The principles for the total cost of energy production are defined by a consideration of the fixed and variable costs. The fixed costs include capital outlay for the plant; the inventory in moderator and coolant; fuel costs; and general operational, maintenance, and management costs. Variable costs include consumption of moderator and coolant and the fuel elements obtained either by lease or purchase. Methods in the calculation of fuel costs are considered for three cases. These are purchase of fuel elements from UKAEC, lease of fuel elements from USAEC, and purchase of fuel elements on open markets. An example is given of the calculation using the cost formula developed. (J.S.R.)

25076

EFFECTS OF THE WATER SYSTEM AND THE DESIGN OF HEATING APPARATUS ON THE PURITY OF THE VAPOR. T. Ch. Margoulova. Compt. rend. congr. intern. chim. ind., 31^e, Liège, Belg., 1958 1, 693-5. (In French)

A report is given of the particulars involved in the use of the method of evaporation by steps in atomic power stations. It is indicated that it is possible to assure, by the use of this method, the safety of the water system of a reactor, in spite of the use of carbon steel for most of the equipment of the power plant. (tr-auth)

25077

PROBLEMS IN NUCLEAR POWER ENGINEERING. E. P. Anan'ev. Gt. Brit. Dept. Sci. Ind. Research, Lending Library Unit Transls. Bull. 2, 764-82(1960) Sept.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 20020.

25078

SUPERHEAT AND THE BWR. 1. WHY AND HOW? 2. NUCLEAR SUPERHEAT—TODAY AND TOMORROW. C. R. Braun. 3. THE "PATHFINDER" CRBR PROJECT. Nuclear Eng. 5, 393-9(1960) Sept.

Superheating steam in the boiling water reactor is desirable because it avoids excessive wetness and improves thermodynamic efficiency. Superheating can be incorporated in nuclear plants either by the addition of a separate oil-fired superheater or by nuclear methods. Evaluation studies indicate that the cost of power from a large nuclear plant using internal nuclear superheat will be less than the equivalent saturated steam plant. The Pathfinder, or Controlled Recirculation Boiling Reactor, is an experimental unit on a commercial scale. With a net output of 62 Mw, it is the largest nuclear-superheat unit of the BWR type under construction. Forced recirculation of the coolant enables accurate control by coolant volume variation and increases the general efficiency of the plant. Core design is complex and consists, in effect, of two concentrically located separate cores. Diagrams of the reactor vessel, core, and plant are included. Based on Pathfinder design data, a target plant with an output of 330 Mw was designed. A simplified flow diagram for this project, with nuclear superheater and reheater, is included. (M.C.G.)

25079

SMALL AND MEDIUM POWER REACTORS. A SURVEY OF CURRENT DESIGNS AND MARKETS. Nuclear Eng. 5, 400(1960) Sept.

Markets for small reactors other than for power generation in underdeveloped countries include reactor experiments on a small scale, reactors for specialized applications, marine propulsion units for merchant ships, and reactors for training and experience. A data sheet is included which itemizes the main parameters of the designs on which manufacturers are currently working. The type, power output, fuel element design, reactor physics, core, coolant, moderator, control, reactor vessel, protection, and steam condition are given for 29 reactors. Diagrams are also included for typical reactors. (M.C.G.)

25080

SIMULATING POWER REACTORS. D. P. Markham. Nuclear Eng. 5, 413-14(1960) Sept.

A reactor simulator was designed in which the analog computation of the power kinetics was undertaken on a logarithmic basis. This approach resulted in the successful coverage of 10 decades of power operation with the normal 0 to 100 v d-c analog computing components. This machine was developed for training purposes. A typical block diagram of a reactor simulator is included. (M.C.G.)

25081

IMPROVEMENTS IN OR RELATING TO MARINE VESSELS. Norman Battle (to Rolls-Royce, Ltd.). British Patent 837,031. June 9, 1960.

A marine reactor configuration is described in which the load on the reactor-supporting structure is reduced by a water-filled compartment within which the reactor is situated. The water also serves as shielding, and its level may be the same as the water level outside the vessel. In fact, the compartment can be bottomless so that the shielding water is in direct contact with the outside water. In seas, the compartment is normally closed to prevent corrosion by salt water. The ducting connections of the reactor preferably are made flexible, e g., by bellows, for thermal expansion. (D.L.C.)

25082

METHOD OF CONSTRUCTING A NUCLEAR REACTOR. Kurt Diebner. British Patent 844,694. Aug. 17, 1960.

A scheme is outlined for producing nuclear fuel for a ship provided with a critical reactor; it consists of the following steps: (1) Natural uranium rods are arranged around a critical reactor, producing plutonium by neutron resonance absorption in U^{238} with a conversion factor >1. (2) The enriched uranium rods are immersed in a water reservoir connected to a duct or channel which leads to the ship. (3) The rods are moved to the ship and placed in its reactor without removal from water, thereby ensuring safety. The advantage of this scheme is that no chemical processes (e.g., isotope separation) are necessary. (D.L.C.)

25083

IMPROVEMENTS IN OR RELATING TO HEAT EXTRACTION SYSTEMS. John Philip Middleton (to Bristol Siddeley Engines, Ltd.). British Patent 845,934. Aug. 24, 1960.

A heat extraction arrangement for high-temperature gas-cooled reactors is described in which the hot gas emerging from the reactor drives the turbine of a turbine-compressor set prior to passing into a heat exchanger, thereby maintaining the coolant circulation. An improvement in efficiency is effected by a bypass in the primary circuit through which a part of the coolant can bypass the turbine and enter a second heat exchanger; in this way, a higher temperature may be attained in the secondary circuit. Several variations of this idea are given. (D.L.C.)

Production Reactors

25084 HW-65333
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
COAGULANT AIDS AS FILTER AIDS. W. R. Conley and R. W. Pitman. July 21, 1960. 7p. Contract AT(45-1)-1350. OTS.

The process of operating Hanford water treatment plants using alum as a coagulant and activated silica as a coagulant aid is compared to the process of using alum as a coagulant and a polyacrylamide as a filter conditioning agent. The latter process was found to be more economical, and the water quality was improved. (C.J.G.)

Research Reactors

25085 ANL-6203
Argonne National Lab., Ill.
A PROPOSED FUEL ASSAY REACTOR. F. H. Martens and H. A. Sandmeier. Aug. 1960. 17p. Contract W-31-109-eng-38. OTS.

There is a need for a special type of nuclear reactor that can test fuel elements nondestructively to determine the total amounts and the distributions of both fissionable and parasitically absorbing materials in completed, unirradiated fuel elements. Such a reactor, called the Fuel Assay Reactor, is proposed. Theoretical considerations are presented to show the reactivity changes that result from the insertion of both fissionable and absorbing material into a central test hole. The choice of moderator depends upon the size of material to be tested. For testing small pellets of fissionable material, a light-water-moderated assembly is advantageous because of its small critical mass; for large, completed fuel elements a graphite or heavy-water-moderated system is more suitable. An internal reflector gives increased sensitivity in the center and allows enough space surrounding the test element so that spectral changes in a nonfuel region may be produced in order to discriminate between fissionable and absorbing materials. The factors determining maximum sensitivity are discussed, as are several reactivity measurement methods suitable for testing fuel elements. The limits of accuracy are governed by the statistical variation of the neutron population within the reactor core. The theoretical limits of accuracy of all methods have the same order of magnitude, but the automatic-flux-level method appears to have advantages over the pile-period and oscillator methods for this purpose. (auth)

25086 CF-60-7-109
Oak Ridge National Lab., Tenn.
RECENT DEVELOPMENTS IN MAGNET DESIGN AND FABRICATION PROCEDURES (BSR TYPE MAGNETS). J. R. Tallackson and R. T. Santoro. July 1, 1960. 31p. OTS.

The techniques of design and fabrication of rod magnets for the Bulk Shielding Reactor II are presented. An experimental model, designed to eliminate the can and its associated air gap, is described. Data on magnet performance are included. (C.J.G.)

25087 CNI-33
Italy. Comitato Nazionale per le Ricerche Nucleari. Centro di Studi Nucleari, Ispra.
ISOTOPIC ANALYSIS OF HEAVY WATER OF THE REACTOR. S. Sandroni. May 1960. 19p.

An isotopic analysis of the heavy water in the Ispra I Reactor was made. Techniques employing infrared spectrometry are described. (C.J.G.)

25088 IDO-16340
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
MTR OPERATIONS HAZARD SURVEY REPORT. M. E. Thomas, D. R. deBoisblanc, R. J. Nertney, and J. H. Rainwater. June 7, 1955. Decl. Apr. 28, 1960. 20p. Contract AT(10-1)-205. (PPC-185). OTS.

Topics included are a resurvey of the original hazards report and discussions of miscellaneous hazards such as nuclear incidents and canal hazards, high-pressure-loop hazards, and hazards of the RMF. (W.L.H.)

25089 IDO-16610(Pt. IV)
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
CALIBRATION OF RMF CONTROL ELEMENTS: IV. RECALIBRATION OF REGULATING ROD. D. W. Knight, D. A. Millsap, and E. Fast. Aug. 12, 1960. 16p. Contract AT(10-1)-205. OTS.

Procedure and calibration tables are presented for the recalibration of the Reactivity Measurement Facility regulating rod. (For Part III see IDO-16610-3.) (C.J.G.)

25090 NP-8988
Worcester Polytechnic Inst., Mass.
SAFEGUARDS REPORT FOR WORCESTER POLYTECHNIC INSTITUTE REACTOR. July 15, 1960. 95p. OTS.

A description and safety analysis of the 1 kw light-water-cooled and -moderated Worcester Polytechnic Institute Pool Training Reactor are given. The reactor design is similar to that of the Bulk Shielding Reactor. (C.J.G.)

25091 NP-9059
Lockheed Nuclear Products, Marietta, Ga.
RADIATION EFFECTS REACTOR GAMMA-OPTIMIZATION CORE TESTS. Period [covered] February 24 to March 1, 1960. R. J. Cashwell and D. E. Kahlson. May 1960. 28p. Contract AF33(600)-38947. (NR-101)

Critical rod configurations, regulating rod worth, and temperature coefficient of reactivity were determined for the Radiation Effects Reactor. The gamma-optimization core performed satisfactorily over the power range (10^{-1} to 10^7 watts) studied. (C.J.G.)

25092 ORNL-2478
Oak Ridge National Lab., Tenn.
OPERATIONAL SAFETY OF THE ORNL GRAPHITE REACTOR USING ENRICHED-URANIUM FUEL. P. R. Kasten, S. Jaye, and M. P. Lietzke. Sept. 8, 1960. 29p. Contract W-7405-eng-26. OTS.

Safety studies were made pertaining to the use of highly enriched-uranium fuel elements in the ORNL Graphite Reactor; these studies were made on the basis that permissible reactivity additions are those which will not cause the fuel elements to melt. Appropriate equations covering power generation, heat transfer, and fluid flow were coded for the Oracle; numerical integration of the equations was performed for various instantaneous reactivity additions, safety-rod response times, and safety-rod reactivity worths. The present natural-uranium system and the proposed enriched system were considered. The countercurrent method of fueling, wherein fuel in adjacent channels is traveling in opposite directions, is recommended for high fuel burn-ups. With this scheme and 40% fuel burn-up and 7-Mw operation, the maximum steady-state fuel temperature was 850°F; the corresponding temperature with 0% burn-up was 800°F. (auth)

25093
PLANNING AND ERECTION OF THE RESEARCH REACTORS MERLIN AND DIDO. L. Hiesinger, W. Krämer, and A. Von Zorkoczy (AEC, Kernenergieanlagen, Frankfurt am Main). Atomwirtschaft 5, 333-9(1960) July-Aug. (In German)

The Merlin and Dido reactors which are to be constructed at Jülich are described with emphasis on the variations from the English prototypes. The nuclear data for the reactors are tabulated. (J.S.R.)

25094
AUXILIARY BUILDINGS FOR THE MERLIN AND DIDO REACTORS. Chrysanth Marnet. Atomwirtschaft 5, 339-43(1960) July-Aug. (In German)

The auxiliary installations needed by the Merlin and Dido reactors are gathered together into two special buildings (hygiene and supply), two reflux cooling plants, a water treatment plant, a pump house, an effluent water control, a technical conference hall, and a multipurpose building. The design of these are briefly described. (auth)

25095
THE INSTRUMENTATION FOR THE MERLIN AND DIDO RESEARCH REACTORS. J. Strobel (Allgemeine Elektricitäts-Gesellschaft, Frankfurt am Main). Atomwirtschaft 5, 343-5(1960) July-Aug. (In German)

A brief survey is given of the instrumentation for the Merlin and Dido reactors. The nuclear instrumentation, control rod operation, conventional instrumentation, and the safety and alarm system are considered. (J.S.R.)

25096
MERLIN AND DIDO—MAIN PARTS, ACCESSORIES, CONSTRUCTION, AND ASSEMBLY. Atomwirtschaft 5, 347-58 (1960) July-Aug. (In German)

Although the Merlin and Dido reactors being constructed at Jülich are based on British prototypes, variations were necessary for improvement and adaptation of the reactors to local conditions. The variations from the British reactors are described in short paragraphs on the reactor hall and rotating crane for Merlin and Dido, leak testing of the pressure shells, the concrete construction, the air-water cooling plant, reactor assembly of Merlin, settling block, radiation tubes, and reactor accessories for Dido, piping for Dido circuits, Dido steel tanks and their manufacture, helium safety gas purification for Dido, graphite installation for Dido, and heavy water cooler for Dido. (J.S.R.)

25097
SHIELDING CONCRETE OF THE KARLSRUHE RESEARCH REACTOR FR-2. Alfred Bauer (Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H., Karlsruhe, Ger.) and Jürgen Seetzen. Beton- u. Strahlbetonbau 54, No. 12, 15p.(1959) Dec. (In German)

The concrete shielding of the Karlsruhe FR-2 reactor is described in detail. The shielding characteristics and structural requirements and characteristics of the material used are outlined. The preparation of the concrete and pouring of the structures are described, and properties of the finished structures are given. (T.R.H.)

25098
THE POSSIBILITIES OF POST-IRRADIATION EXAMINATION ASSOCIATED WITH THE BR-2 REACTOR. J. Planquart (Centre d'Etudes de l'Energie Nucléaire, Brussels). Bull. inform. assoc. belge develop. pacifique énergie atomique No. 27, 3-8(1960) July. (In French)

The experimental study of the behavior of materials in research reactors assumes the possibility of subjecting the irradiated material to various chemical, metallurgical, and other investigations. The criteria for post-irradiation examination are cited, and the possible solutions are discussed. The facilities of the BR-2 Reactor, especially the hydraulic transfer system, are described. (J.S.R.)

25099
RESEARCH REACTOR FAULT ANALYSIS. J. C. Moore (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Eng. 5, 385-90(1960) Sept.

A method utilizing a punched-card-data processing system was developed for recording and analyzing the main features of reported faults affecting the operation of research reactors. The important features of any fault are distinguished by means of codes signifying plant type, and fault type and its importance and a specific code for additional information about the fault. All information recorded in this manner can be quickly retrieved and presented in a variety of chosen orders. Several tables are included giving examples of the code and its use. (M.C.G.)

25100
GAS-TIGHT CABLE CONDUITS IN KARLSRUHE REACTOR FR-2. Karl Hitzig. (Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H., Karlsruhe, Ger.). Siemens-Z. 33, 630-4(1959) Oct. (In German)

Details are given of cable and cable conduit arrangement and construction in the reactor buildings for the Karlsruhe FR-2. The underpressure requirement for the reactor safety containment shell imposes gas-tightness requirements on the leads, connectors, and other cable fixtures. (T.R.H.)

25101
CONSTRUCTION OF THE RESEARCH REACTOR AT MUNICH. Nikola Dimitrov (Technische Hochschule, Karlsruhe, Ger.). VDI Zeitschrift 102, 1140-8(1960) Aug. 21. (In German)

The swimming pool reactor developed at Oak Ridge, Tenn., served as the prototype for the research reactor at Munich. The hall of the Munich Reactor, however, was designed to take into consideration the local conditions. An ellipsoid shell of reinforced concrete was selected as the supporting construction. To a large extent only stressed diaphragm forces are considered because the marginal and crown disturbances are quickly damped. As a result of the dead weight and internal excess pressure, the diaphragm forces were used as the basis for determining the shell dimensions. The effect of the wind is less than that of the excess pressure and was only given special consideration when determining the bearing load. Water and concrete are used as a shield against radiobiologically dangerous radiation. The shielding effect is so good that the radiation emitted is much smaller than the admissible dose. (auth)

WASTE DISPOSAL AND PROCESSING

25102 AERE-R-3137
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN EXPERIMENTAL STUDY OF ELECTRODEIONISATION AND ITS APPLICATION TO THE TREATMENT OF RADIOACTIVE WASTES. D. C. Sammon and R. E. Watts. June 1960. 51p. BIS.

Electrodeionization was investigated for the treatment of low-level wastes. Studies on Na salt solutions in the range 10^{-2} to 10^{-3} N revealed the process can reduce this amount of salt by $\frac{1}{2000}$ and concentrate the effluent up to 100 times the influent. The performance of the three-compartment and multi-compartment cells is expressed in terms of a parameter which is a simple function of solution concentrations, flow rates, and desalting current. Deionization of solutions containing Ca^{2+}, Fe^{++}, or PO_4^{+++} ions or anionic detergent was investigated. (C.J.G.)

25103 CRER-932

Atomic Energy of Canada Ltd., Chalk River, Ont.

MOVEMENT OF RADIOACTIVE WASTES THROUGH SOIL. 1. SOIL AND GROUND-WATER INVESTIGATIONS IN LOWER PERCH LAKE BASIN. P. J. Parsons. June 1960. 55p. (AECL-1038). AECL.

The movement of wastes through soil and by ground water was studied in Perch Lake Swamp in the Chalk River Project area. (C.J.G.)

25104 ORNL-2899

Oak Ridge National Lab., Tenn.

MARITIME REACTOR WASTE DISPOSAL STUDIES: SOLIDIFICATION OF ION-EXCHANGE RESIN WITH PORTLAND CEMENT FOR RADIOACTIVE WASTE DISPOSAL. R. R. Holcomb. Sept. 13, 1960. 15p. Contract W-7405-eng-26. OTS.

A procedure is reported for the sea disposal, by fixation in concrete, of ion-exchange resins containing sorbed fission products and filtered corrosion products. The results of sea disposal of both treated and untreated resins is presented. For the fixation of nuclear-reactor-system demineralizer resin in cement, a mixture of 2 parts of cement, 1 part of resin, and 1 part of water was found to be optimum. A concrete block prepared by this receipt showed only 0.44% of the gross γ activity leached after 2540 hr of contact with simulated sea water. The data indicate that very little or no further leaching will occur. (auth)

25105 HW-64675

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A STUDY OF THE EFFECTS OF SOME SPRAY COLUMN VARIABLES ON RADIANT-HEAT TRANSFER IN SPRAY CALCINATION (thesis). Rudolph Theodore Allemann. Apr. 28, 1960. 56p. Contract AT(45-1)-1350. OTS. Submitted to the Univ. of Idaho.

A study of the heat-transfer mechanisms associated with large-capacity radiant-heat spray calciners was conducted by examination of the reactor calcination profile and by determining the eddy diffusivity within the column. The velocity profile of turbulent flow was found to account in large part for the observed calcination profile in the calciner. The shape of the calcination profile can be predicted by utilizing the velocity profile and radiant-heat-transfer equations. (J.R.D.)

25106

THE DEACTIVATION PLANT AT JULICH ATOMIC RESEARCH CENTER. K. H. Rattay (Gesellschaft zur Förderung der Kernphysikalischen Forschung e. V., Jülich, Ger.). Atomwirtschaft 5, 365-8(1960) July-Aug. (In German)

The radioactive wastes, separated according to nuclide and concentration, are treated in the deactivation plant. The radioactive water is brought to the plant by tankers. There is a dump for solid residues. (auth)

25107

NUCLEAR WASTE DISPOSAL BY FLUIDIZED CALCINATION OF SIMULATED ALUMINUM-TYPE WASTES. James D. Jackson, Harold A. Sorgenti, Gerald A. Wilcox, and Robert S. Brodkey (Ohio State Univ., Columbus). Ind. Eng. Chem. 52, 795-8(1960) Sept.

Studies were made on the dehydration and decomposition of $Al(NO_3)_3$ crystals and solutions in order to elucidate the reactions occurring in spraying $Al(NO_3)_3$ solutions into a hot fluidized bed of Al_2O_3 particles. The investigation was carried out in two parts. These were as follows: (1) Preliminary studies. Differential thermal analysis was done on $Al(NO_3)_3 \cdot 9H_2O$ vs. the calcined product by heating them side by side from 30 to 430°C. After the initial endothermic change (solution in hydration water and dehydration), a highly endothermic process begins at ~145°C with NO_2 evolution and continues up to 200°C, above which the sample and reference begin to equalize. Thermogravimetric analysis was also done on $Al(NO_3)_3 \cdot 9H_2O$ at 100 to 500°C for kinetic studies. The rate below and above 200°C was first order, whereas the rate at 200°C was zero order. The reaction above 200°C is probably physical-controlled rather than chemical-controlled since an activation energy of 7.8 kcal/mole was obtained for the 300 to 500°C range. (2) Fluid bed decomposition. The equipment was made of type 304 stainless steel; data on the corrosion of various metals by 2.4 $\underline{M}$ $Al(NO_3)_3$ are given in support of this choice. Details of the construction and operation of the bed reactor are given. Both solution- and solid-feed runs were made at 400°C, and after each run the bed and cyclone dust were weighed and analyzed for residual nitrate. The solution-feed runs indicated that at feed rates above 10 ml/min bed agglomeration with unreacted $Al(NO_3)_3$ became a problem. The solid-feed-run data were compared with predicted reaction rates from thermogravimetric data, and it is concluded that the fluid bed is physical-controlled (activation energy = 6.0 kcal/mole) and may be controlled by either heat or mass transfer to the particles. It was found that a wider particle distribution in the solid-feed runs improved bed fluidization and hence efficiency. (D.L.C.)

25108

THE TREATMENT OF RADIOACTIVE WASTES WITH ION EXCHANGE MEMBRANE ELECTRODIALYZER. Mutsumi Nishidoi (Atomic Energy Research Inst., Tokyo), Masukuni Ito, and Yutaka Yamamoto. J. Atomic Energy Soc. Japan 2, 460-7(1960) Aug. (In Japanese)

The treatment of low-level radioactive wastes by electrodialysis employing ion exchange membranes was studied. It was found that the electrodialyzer JAERI-300B had good properties for demineralizing brine water, and it was applied for the treatment of actual radioactive wastes. From the experiments it was concluded that the transfer rate of either non-radioactive or radioactive ions through ion exchange membranes was nearly equal. Therefore the electrodialyzer required no special modification for the treating of the radioactive wastes. In two-stage treatment the concentration of effluent from the electrodialyzer rose to 100 times the initial feed, so that the evaporating cost was reduced markedly. At the same time the concentration of demineralized effluent decreased to one-tenth, and the volume of break-through from the final ion exchange tower increased ten times. The power necessary for the electrodialysis was only 1 kwh/m^3 when demineralizing from 2,000 to 20 ppm, and the over all power requirement including three pumps for feed, circulate, and discharge, was only 10 kwh/m^3. The current efficiency of this electrodialyzer was over 70%. (auth)

25109

RADIOISOTOPES AND ENVIRONMENTAL CIRCUMSTANCES: SIGNIFICANCE OF NUCLEAR INDUSTRY EFFLUENTS IN ANIMAL POPULATIONS. Leo Bustad (General Electric Co., Richland, Wash.). p.243-54 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Nuclear industry has been the most closely scrutinized of any industry and has proved to be the safest of industries. The significance of nuclear industrial effluents on animal populations is discussed. The roles of nuclear fuel preparation, reactor operations, and chemical separations facilities as effluent contributors to the environs are surveyed. Both gaseous and liquid effluents are considered. Monitoring procedures are described. Tabulated data on the accumulation of radioisotopes by animals in the environs of the Hanford Works are presented and discussed. Results of numerous metabolic studies on animals are reviewed. The potential hazards of fission products in the food chain are considered. 15 references. (C.H.)

DEPOSITORIES OF USAEC REPORTS IN NON-U.S. LIBRARIES

The libraries at the organizations listed below maintain collections of unclassified U. S. Atomic Energy Commission reports for reference use.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica

AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission

AUSTRIA
Vienna, Zentral Bibliothek der Physikalischen Institute der Universität
Vienna, International Atomic Energy Agency

BELGIUM
Brussels, Centre d'Etudes pour les Applications de l'Energie Nucléaire
Brussels, La Bibliotheque EURATOM

BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao

BURMA
Rangoon, Union of Burma Applied Research Institute

CANADA
Hamilton, McMaster University
Ottawa, National Research Council Library
Vancouver, University of British Columbia

CEYLON
Colombo, University of Ceylon

CHILE
Santiago, Ministerio de Relaciones Exteriores

CHINA
Hsinchu, Formosa, National Tsing Hua University Library

COLOMBIA
Bogotá, Comisión de Energía Atomica de Colombia

COSTA RICA
San Pedro, University of Costa Rica Library

CUBA
Havana, Comisión de Energía Nuclear de Cuba

DENMARK
Risö, Danish Atomic Energy Commission

DOMINICAN REPUBLIC
Ciudad Trujillo, National Palace

ECUADOR
Quito, Escuela Politécnica Nacional

EGYPT
Cairo, Atomic Energy Commission

EL SALVADOR
San Salvador, Universidad Nacional, Facultad de Ingenieria

ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
Manchester, Central Library
Newcastle upon Tyne, Central Library
Nottingham, Public Libraries
Sheffield, Central Library

FINLAND
Helsinki, Teknillisen Korkeakoulun Kirjasto

FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Académie des Sciences
Paris, European Nuclear Energy Agency, O. E. E. C.

GERMANY
Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek

GHANA
Accra, University College of Ghana

GREECE
Athens, Greek Atomic Energy Commission

GUATEMALA
Guatemala, Comisión Nacional de Energía Nuclear

HAITI
Port au Prince, University of Haiti

HONDURAS
Tegucigalpa, Comisión Hondureña de Energía Atómica

ICELAND
Reykjavik, University of Iceland, Atomic Energy Library

INDIA
Bombay, Department of Atomic Energy

INTER-AMERICAN NUCLEAR ENERGY COMMISSION
Washington, D. C., Pan American Union

IRAN
Tehran, Tehran University Center for Nuclear Studies

IRAQ
Baghdad, Iraqi Atomic Energy Commission

IRELAND
Dublin, University College

ISRAEL
Tel Aviv, Israel Atomic Energy Commission

ITALY
Milan, Centro di Studi Nucleari di Ispra del C.N.R.N.
Rome, Comitato Nazionale per le Ricerche Nucleari

JAPAN
Tokyo, Science Section, Diet Library

KOREA
Seoul, Atomic Energy Research Institute

LEBANON
Beirut, American University

LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity

MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear

NETHERLANDS
The Hague, Reactor Centrum Nederland

NEW ZEALAND
Wellington, Department of Scientific and Industrial Research

NORTHERN IRELAND
Belfast, Department of Industrial and Forensic Science

NORWAY
Lilleström, Institutt för Atomenergi

PAKISTAN
Karachi, Atomic Energy Commission

PERU
Lima, Biblioteca Nacional

PHILIPPINE REPUBLIC
Manila, Philippine Atomic Energy Commission

POLAND
Warsaw, Biura Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej

PORTUGAL
Lisbon, Junta de Energía Nuclear

REPUBLIC OF THE CONGO
Leopoldville, Université Lovanium

SCOTLAND
Glasgow, Mitchell Library

SPAIN
Madrid, Junta de Energía Nuclear

SWEDEN
Stockholm, Atomenergi AB

SWITZERLAND
Geneva, United Nations Library
Zurich, Institut für Physik, Eidg. Technische Hochschule

THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science

TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library

UNION OF SOUTH AFRICA
Pretoria, Atomic Energy Board Library, Council for Scientific and Industrial Research

UNITED NATIONS
New York, N. Y., U.N. Headquarters

URUGUAY
Montevideo, Universidad de Montevideo

VENEZUELA
Caracas, Instituto Venezolano de Investigaciones Cientificas

VIET-NAM
Saigon, Office of Atomic Energy

YUGOSLAVIA
Belgrade, Federal Nuclear Energy Commission

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300

TECHNICAL PROGRESS REVIEWS

The U. S. Atomic Energy Commission, Office of Technical Information, publishes an unclassified series of Technical Progress Reviews which provide concise summaries of current atomic developments. Issued quarterly, each of these Technical Progress Reviews digests and evaluates the latest findings in a specific area of nuclear technology and science. The Reviews also report on technology developed in military reactor and other classified AEC programs to the extent that the technology can be dissociated from sensitive military and production data.

The four journals published in this series are:

Nuclear Safety, W. B. Cottrell, editor, R. A. Charpie, advisory editor, and associates, Oak Ridge National Laboratory

Power Reactor Technology, Walter H. Zinn and associates, General Nuclear Engineering Corporation

Reactor Core Materials (covering solid material developments), R. W. Dayton, E. M. Simons, and associates, Battelle Memorial Institute

Reactor Fuel Processing, Stephen Lawroski and associates, Chemical Engineering Division, Argonne National Laboratory

Each journal may be purchased by subscription (domestic, $2.00 a year; foreign, $2.50 a year) or by individual issue (55¢) from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.